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Background Document on Clean Products Research and Implementation

Franklin Associates Ltd., Prairie Village, KS

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FOREWORD

Today's rapidly developing and changing technologies and industrial products and practices frequently carry with them the increased generation of materials that, if improperly dealt with, can threaten both public health and the environment. The U.S. Environmental Protection Agency is charged by Congress with protecting the Nation's land, air, and water resources. Under a mandate of national environmental laws, the agency strives to formulate and implement actions leading to a compatible balance between human activities and the ability of natural systems to support and nurture life. These laws direct the EPA to perform research to define our environmental problems, measure the impacts, and search for solutions.

The Risk Reduction Engineering Laboratory is responsible for planning, implementing, and managing research, development, and demonstration programs to provide an authoritative, defensible engineering basis in support of the policies, programs, and regulations of the EPA with respect to drinking water, wastewater, pesticides, toxic substances, solid and hazardous wastes, and Superfund-related activities. This publication is one of the products of that research and provides a vital communication link between the researcher and the user community.

This report, Background Document on Clean Products Research and Implementation, explores one of the newer types of programs aimed at reducing the harmful impacts on the environment resulting from the production, use, and disposal of goods. Clean products programs are set up to identify products which cause the least negative impact on the environment and to encourage and support environmentally sound products and technology. Results of an effective clean products prodgram may include reduction in the quantity and toxicity of solid waste; reduction of air, water, and soil pollution; and conservation of energy and resources. This report, prepared for the Pollution Prevention Research Branch of the U.S. Environmental Protection Agency, provides background information which may be useful in the conduct of clean products research in the United States.

E. Timothy Oppelt, Director
Risk Reduction Engineering Laboratory

ABSTRACT

The concept of "clean" or "environmentally friendly" products, or those which cause the least negative impact on the environment, has become a major issue in the marketplace in recent years.

A product and its packaging may impact the environment in many ways (air, water, and soil pollution; resource and energy usage, etc.) at any or all stages of its life cycle, from raw material extraction through disposal. Assessing all the environmental impacts and comparing products on a technically justifiable basis is very difficult. As a result, most "clean product" claims are made on the basis of only one or a few environmental impacts.

The two main purposes of a clean products program are to identify products which cause less damage to the environment and to encourage the development of environmentally sound products and technology. In order to direct the power of consumer spending toward clean products, environmental impacts must be accurately evaluated and the information communicated to consumers.

Several countries have official programs in place or proposed to award environmental labels to products that meet specified environmental requirements. Programs in West Germany, Canada, Japan, the Nordic countries, and Australia are discussed in some detail in this report. Various types of efforts in the U.S. are covered, including environmental action books and shopping guides, legislative efforts, and individual manufacturers' and retailers' programs. Types of products which have been evaluated and the reasons for their selection are also discussed.

The criteria and methodologies used to evaluate products are critical elements of a clean products program. Various criteria are listed, along with discussions of how criteria have been applied to various product groups. This report also examines a variety of methodologies, ranging from the comprehensive and complex product life cycle approach (covering environmental impacts at each stage from raw materials extraction through disposal) through various simplified approaches, each with its own limitations. Advantages and disadvantages of each method are

examined. A section is devoted to problematical issues that must be addressed when establishing a clean products program.

An annotated bibliography provides summaries of the articles and reports researched to prepare this document, including the most recent information from other countries on their clean products programs.

This report is submitted in fulfillment of EPA Contract No. 68-01-7310, Work Assignment No. 125, by Franklin Associates, Ltd. under subcontract to NUS Corporation under the sponsorship of the U.S. Environmental Protection Agency. The report covers a period from January 9, 1990 to June 29, 1990, and work was completed as of June 29, 1990.

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Chapter 1

INTRODUCTION AND OVERVIEW

PURPOSE OF THE REPORT

The concept that products can be made "environmentally friendly" or "clean" has been attracting much attention and action in the United States and abroad. This clean products approach can potentially be applied at all stages in the waste management hierarchy as established by the Environmental Protection Agency: source reduction, recycling, treatment, and disposal. The approach goes well beyond solid waste management issues, since other environmental considerations such as impacts on the air and water should be included.

While the concept of environmentally friendly products is easy to endorse, there is as yet no universally accepted definition of what is meant by "environmentally friendly" or "clean," nor any agreement on how to achieve clean products as an objective. This report has been prepared to provide background information on the current state of research activities and implementation on the subject of clean products, and to identify issues that must be resolved as programs are implemented. The focus of this report is on consumer products, although the same methodologies and criteria can be used for any product or process.

THE LIFE CYCLE OF PRODUCTS

For at least two decades there has been recognition, at least among thoughtful people, that the manufacture, use, and disposal of products can impact on resources and the environment at every stage in the product's life cycle. The life cycle of a product moves from extraction of raw materials to processing stages and on through manufacture of the product (or package for a product). The product then goes through the distribution channels (wholesaler, retailer) to the consumer. Finally the product is consumed, disposed of, or perhaps recycled. At every stage in the product's life cycle, the environment may be affected (e.g., through air emissions, effluents, solid waste generated, etc.). Also, energy can be required for every step in the life of a product and, of course, raw materials are used to manufacture the product.

While there is general agreement that it is desirable to minimize a product's overall impact on resources and the environment, it is not so easy to determine what the impacts really are, and how one product compares to another. Many claims that a given product is "environmentally friendly" are based on only one of the many possible points of impact or types of impact on the environment. The chapters that follow describe in more detail the currently used and planned criteria and methodologies for evaluating clean products.

OVERVIEW OF CRITERIA AND METHODOLOGIES USED TO EVALUATE PRODUCTS

There is a well developed life cycle analysis methodology that has been used to evaluate products for about 20 years. This methodology considers environmental impacts and resource use at all the steps ("cradle to grave") in a product's life. This evaluation methodology and the products to which it has been applied are described in much more detail in later chapters.

Many other efforts have been made to categorize products as clean or environmentally friendly using one or only a few criteria. A feel for the variety of criteria used and products evaluated can be gained by examining Table 1-1. The potential for polluting water, soil or air or the potential for reduced resource or energy usage are the most prevalent criteria used in a variety of programs, including those in other countries. A wide variety of consumer products have been evaluated.

In the chapter that follows, existing and proposed clean product programs in the United States and abroad are briefly discussed as well as products for which criteria/methodologies have been developed. Separate chapters are devoted to more detailed discussions of the criteria and methodologies that have been used and proposed. Finally, some of the issues and technical problems remaining to be resolved are addressed.

Table 1-1

OVERVIEW OF CRITERIA USED BY VARIOUS GROUPS TO EVALUATE PRODUCTS

Criteria	Paper Products (General)	Paper Products (Recycled)	Plastic Products (General)	Plastic Products (Recycled)	Diapers	Batteries	Detergents	Aerosols	Appliances	Shopping Bags	Paints	Glass Containers	Lawn Mowers	Rerefined Oil
Recycled Content	CO, E	WG1, C1	CO, E	WG1, C1						E		E		C1
Recyclability/Reusability	CO, E		CO, E		C1, E	E				C1, E		WG1, E		
Degradability	E		E		E		E			E				
Hazardous/Toxic Content	CO	C	CO, E		E	WG1, C1, E1	E	WG, E			WG1, C1, E			C
Water Pollution		WG*, C*, E	E	WG*, C*	C*, E	WG*, C*, E	E	WG*	WG*, C*	C*, E	WG*, C*, E	WG*	WG*	C*
Soil Pollution		WG*, C*		WG*, C*	C*, E	WG*, C*, E		WG*	WG*, C*	C*, E	WG*, C*, E	WG*	WG*	C*
Air Pollution		WG*, C*	E	WG*, C*	C*	WG*, C*		WG1, E1	WG*, C*	C*, E	WG*, C*	WG*	WG*	C*
Noise Pollution													WG1	
Production Processes	E													
Resource/Energy Usage	E	WG*, C*	E	WG*, C*	C*, E	WG*, C*		WG*	WG1, C1, E1	C*, E	WG*, C*, E	WG*	WG*	C*

Key:

WG	West German Blue Angel labeling program
C	Canadian Environmental Choice labeling program
E	Environmental guides (various)
CO	Coalition of Northeastern Governors (CONEG)
1	Primary or single criterion (No number indicates consideration as a secondary, or one of many, criteria.)
*	Based on group's claim to lifecycle approach, this should be considered, but no specifications given to indicate that this criterion individually addressed.

Criteria may be used to evaluate product in a positive or negative sense. Indication of consideration of a criterion does not necessarily imply a thorough or technically sound treatment of the subject.

Chapter 2

EXISTING AND PROPOSED CLEAN PRODUCTS PROGRAMS

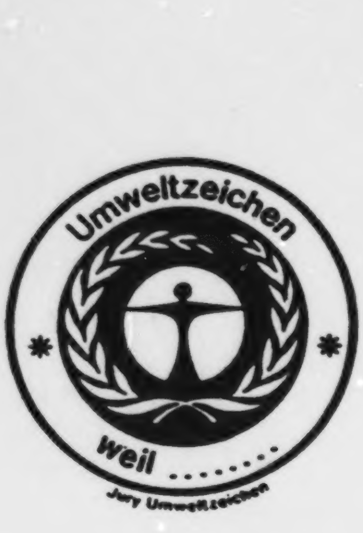
COUNTRIES AND GROUPS THAT HAVE IMPLEMENTED PROGRAMS

With the rising tide of green consumerism, the marketing of products as "clean" or "environmentally friendly" is growing exponentially. Existing labeling programs range from well-controlled national programs and simple shopping guidelines recommended by various consumer/environmental groups to labeling claims with undefined technical basis made by manufacturers and retailers trying to cash in on consumers' rising concern for the environment. Unfortunately, it is difficult for the consumer, confronted with a vast array of products and conflicting or incomplete information, to assess the technical accuracy of labeling claims and make an educated decision as to which products are better for (or more accurately, least harmful to) the environment.

In this chapter, a number of the "environmentally friendly" labeling programs in existence as well as some shopping guides are described, with particular emphasis on their technical basis, and, if known, the sources of environmental impact data and the techniques used to evaluate them.

Germany: Blue Angel (11, 23, 25, 32, 60)

The Federal Republic of Germany is clearly the pioneer in the field of national environmental labeling. Its "Blue Angel" program has been in existence since 1978 and is widely used as a model by other countries and organizations in developing their own labeling systems. Over 3000 products in 57 product categories now carry the Blue Angel label, which was adapted from the logo of the United Nations Environment Programme. The logo consists of a blue angel flanked by stalks of grain with the words "Environmental label because..." and a short general description of the product's environmental impact (Figure 2-1). Originally, the label's wording was "Environment-friendly because..." but was changed in 1988 because of the consensus that products are not beneficial to the environment, but more or less harmful (25).


Umweltzeichen
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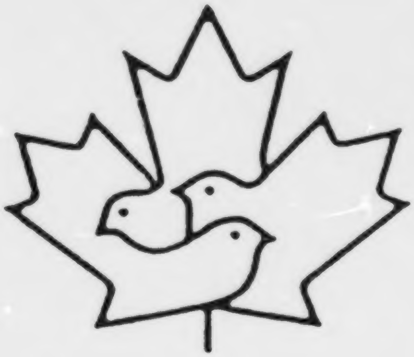
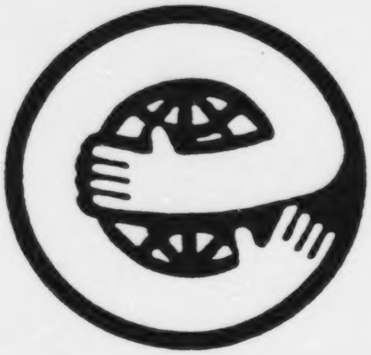
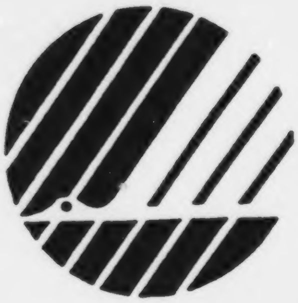
WEST GERMANY - Blue Angel



CANADA - Environmental Choice



JAPAN - Ecomark



Nordic Environmental Label

Figure 2-1

ENVIRONMENTAL LABELS USED
IN OTHER COUNTRIES

The Blue Angel program defines clean products as those which

> "when compared with other products fulfilling the same function and when considered in their entirety, taking into account all aspects of environmental protection (including the economical use of raw materials), are, as a whole, characterised by a particularly high degree of environmental soundness without thereby significantly reducing their practical value and impairing their safety." (60)

The labeling process involves three groups: the Federal Environmental Agency (FEA), the Environmental Labeling Jury (Jury Umweltzeichen), and the Institute for Product Safety and Labeling (RAL). Briefly, the process works this way: The FEA appoints a group of experts who define the detailed criteria for each product category. Upon approval of the criteria by the EL Jury, the RAL then assesses products against the criteria. Testing may also involve the Stiftung Warentest, a consumer quality test organization.

It is claimed that a cradle-to-grave approach is used in evaluating products for the label; however, it appears that, lacking any outstanding environmental impacts in other areas, differentiation of products in a given category is usually made on a single criterion. This criterion may be recycled content, reusability, or some other environmental concern. A report presented by Dr. Edda Muller at the European Free Trade Association (EFTA) countries' labeling seminar in August 1989 (25) stated that product testing is comprehensive, and includes consideration of

> "the whole production cycle (choice of raw materials, manufacture, utilization, disposal), all aspects of environmental protection (content of hazardous substances, emissions of pollutants into the air, water and the soil, noise emissions, waste avoidance, reduction and recycling, sparing use of natural resources particularly in the consumption of energy, water and raw materials), and aspects of useability and safety (industrial safety and protection of health)." (25)

Additionally, it was stated that, for a specific group of products, the requirements may be narrowed down because

> "one particular environmental aspect, e.g. noise emission, may not be relevant for the group of products concerned; products offered on the market defy differentiation with regard to their environmental

properties (although products showing serious problems are already discarded in the earlier stage of selection as being unsuitable for the granting of an environmental label); or there is a lack of available information, for example in the manufacturing process (should serious problems be suspected, the product group is discarded during the selection process)." (25)

Criticisms of the program include the following:

- Failure to update (tighten) criteria frequently enough to keep them relevant to technical progress (23). For example, only last year was the requirement for recycled paper content in various paper products raised from 51 percent to 100 percent (11).

- Not enough emphasis on quality and useability of labeled products (23). It was stated in the report by Environmental Data Services Ltd. that acrylic paints bearing the Blue Angel label have been inferior in performance to traditional products. For this reason, a consumer testing organization has now been included in the testing process to verify overall quality. It is important that consumers do not associate an environmental label with products that do not work.

- Using a single environmental criterion (23). While this may simplify product evaluation and make clearcut choices easier for the consumer by indicating exactly what product trait the label has been based on, it fails to adequately take into account other potentially significant environmental impacts of a product. For example, the label may be awarded to recycled paper products made by several different manufacturers, but it is not clear that any real, in-depth comparison has been made of their deinking, bleaching, and other manufacturing processes, and whether they may not in fact use more energy or produce more waste than a process using virgin material.

- Failure to provide labeling opportunity for all products in a product group. Specifically, criteria were developed for low-solvent paints, allowing them to qualify for an environmental label, while environmentally preferable water-based dispersion paints were not labeled. The response to this criticism was that water-based paints are not suitable substitutes for all low-solvent paint applications, and water-based paints already dominated the market in those applications where they compete with low-solvent paints; therefore, it was not considered necessary to label water-based paints (32).

- Since the label award is based on voluntary participation of companies (with a licensing fee involved), there is no guarantee that an unlabeled product may not be equally as environmentally sound as a labeled one, or even superior, but perhaps its manufacturer has not chosen to apply for a label (23). This is unfortunate from a pure environmentalist, informational point of view, although companies which do not choose to apply for the label must realize that they may lose some market share because of this.

- Because of restrictions on some product categories which have excluded them from consideration for the Blue Angel, some manufacturers are using their own labels, which may lead to consumer confusion (23). For example, the guidelines for non-CFC aerosol products excluded any products containing harmful substances. Therefore, manufacturers of some cleaning products have used their own CFC-free labels. In the absence of the officially approved label with its clearly defined criteria to which consumers have become accustomed, shoppers now do not know whether product improvements in the one area have been offset by problems in another, and may understandably become confused.

This last issue is not intended as a criticism of the Blue Angel program, but rather as an indication of the value manufacturers are now placing on consumers' environmental concerns and the effect on their purchasing decisions. In some cases, this has been sufficient motivation for manufacturers to make large investments in equipment to manufacture more environmentally sound products that can be marketed with the Blue Angel logo.

Canada: Environmental Choice (11, 15, 20, 21, 22, 23, 39)

Canada's Environmental Choice program produced its first three guidelines last summer, and as of May 15, 1990 had 11 approved product category guidelines and six draft issues out for public review (Table 2-1)(15, 20).

The Environmental Choice logo is a maple leaf made of three doves, representing the interaction of government, industry, and consumers (Figure 2-1). The program literature discourages use of the term "environmentally friendly" in favor of referring to products which "reduce the burden on the environment." A product which is a good environmental choice is "any product which is made, used or disposed of in a way that causes significantly less harm to the environment than other similar products." (22)

Table 2-1

GUIDELINES ISSUED BY CANADA'S ENVIRONMENTAL CHOICE PROGRAM

FINAL GUIDELINES

Re-refined lubricating oil (ECP-01-89)
Construction materials from wood-based cellulose fiber (ECP-02-89)
Products made from recycled plastic (ECP-03-89)
Batteries: zinc-air (ECP-04-89)
Paint: water-based (ECP-07-89)
Fine paper from recycled paper (ECP-08-89)
Miscellaneous products from recycled paper (ECP-10-89)
Newsprint from recycled paper (ECP-11-89)
Heat recovery ventilators (ECP-13-89)
Diapers: cloth (ECP-14-89)
Solvent-based paints (ECP-12-89)

DRAFT GUIDELINES

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Sanitary paper from recycled paper (ECP-09-89)
Diaper services (ECP-21-90)

The labeling process is similar to West Germany's, involving three main organizations: The Environmental Choice board, consisting of experts from various fields; a secretariat within Environment Canada; and an independent testing organization, the Canadian Standards Association (CSA). The Board reviews product category reports containing information on the product's environmental impact throughout its life cycle and related opportunities to reduce the burden on the environment. The CSA then drafts a set of criteria, which, after approval by the Board, is released for 60-day public review. The Board may revise the guidelines based on input during the public review, then submits the final guidelines to the Minister of the

Environment for approval. As in the Blue Angel program, a licensing fee is involved for use of the Ecologo, and use of the logo is granted for a limited time.

Technical criteria are specified in the individual product guidelines. Canada also claims to use a cradle-to-grave approach in assessing products. The guidelines typically contain a general statement that "based on a review of currently available product life cycle information, the product category requirements will produce a net environmental benefit or improvement." Each guideline also contains specific requirements for the product category, such as the requirements that labeled lubricating oil must have been manufactured using over 50 percent by volume re-refined oil in the base stock and must contain less than 5 ppm chlorinated compounds and less than 25 ppm metals (15). Guidelines also contain a statement that various stages of the life cycle (specified for each product category) must be accomplished in such a manner that all steps of the process meet the requirements of the Canadian Environmental Protection Act and all applicable governmental regulations.

Japan: EcoMark (11, 23, 32, 33)

Japan's environmental labeling program, based on the West German Blue Angel program, was launched in February 1989. The program aims to promote "clean" innovation by industry, heighten consumers' environmental awareness, recommend products which contribute to environmental protection and conservation, and symbolize an ecological lifestyle.

The logo consists of arms encircling the earth, forming an "e" shape (Figure 2-1). The wording consists of the statement "Gentle to the Earth" along with a specific reason associated with each product category. "Clean" products considered for the label are those which cause little or no pollution when used or discarded, improve the environment in use, or otherwise contribute to conservation of the environment. The logo's use will also be applied to environmentally favorable activities such as recycling programs.

The Ecomark Office at the Environmental Agency plays the central coordinating role. The Environment Agency selects product groups, and the Japan Environment Association approves or disapproves them, with input from the expert Ecomark Promotion Committee. The Committee sets standards for product approval and is responsible for approving certification of applicants for the label (33).

To qualify for the Ecomark, products must have been manufactured with attention given to the following:

- Preventive measures must be taken against environmental pollution in manufacturing.
- Disposal of the product must not involve difficult processing.
- There must be an opportunity for conserving energy or resources through use of the product.
- Compliance with quality and safety laws, standards, and regulations must be demonstrated.
- Price must not be excessively higher than that of comparable products.

The Ecomark only distinguishes products on the basis of environmental protection and does not attempt to set standards for quality and safety (33). As in the West German and Canadian programs, use of the labels is voluntary, involves a fee, and is valid for a limited number of years.

The program started in February 1989 with seven product groups, and six more were added in August. In the first six months, 151 products were approved. Product groups which have been labeled include books and magazines from recycled papers, personal care aerosol products with no CFC propellants, kitchen strainers and filters, and compost makers. Detailed criteria for various products have not been made available.

Nordic Countries (11, 25, 32, 41, 42, 54)

The most recent entrants into the field of organized environmental labeling are the Nordic countries. On November 8, 1989, the Nordic Council of Ministers agreed to implement a voluntary and positive environmental labeling program. The program will use common criteria developed with the cooperation of all participating Nordic countries and a common label, a green and white striped circle with a swan, based on the emblem of the Nordic Council of Ministers (Figure 2-1). The environmental performance of selected product groups will be assessed in terms of such factors as raw material extraction, production processes, and product use and disposal, and a set of minimum requirements will be established. In some cases, the label will be granted to the least harmful product in a group, while in other cases the label will be granted to products that represent an alternative, more environmentally sound means of satisfying consumer needs (41).

Participation of individual Nordic countries will be on a voluntary basis. Norway, Sweden, Iceland, and Finland have all indicated that they will participate, while Denmark is waiting to see whether the European Economic Community will adopt a labeling program before it decides whether to participate (41).

A Nordic Environmental Labeling Committee will be established under the Council of Ministers, with a secretariat in the Council of Ministers. Each participating country will organize its own national committee to run the program. The national committee will define product groups and criteria, subject to approval by the Nordic labeling committee, which will have the final say.

All Nordic countries may participate in meetings of the Nordic Environmental Labeling Committee, but only those participating in the labeling program may vote. The national committees will also handle individual applications for use of the label. An application approved by any country's national committee will automatically be valid in all of the participating Nordic countries. The first labeled products are anticipated to be on the market toward the end of 1990.

The Nordic countries also plan to keep well-informed on developments in environmental labeling on a European Community level, with an eye to future coordination with an EC system.

So far, Sweden and Norway have set up national committees; Finland is expected to join later this year, although there appear to be some reservations on Finland's part regarding the use of a simple symbol to represent the sum of all the complicated environmental impact factors associated with a given product or product group. The main concern is that oversimplification may mislead consumers. The Swedish Society for Conservation of Nature, addressing the same issue of how to compare all environmental impacts, has suggested that the starting point for labeling criteria be focused on what is believed to be the most important aspect of the product group's environmental impact. Evaluations (subject to revision as knowledge increases) should be made upon the most extensive background information available, but some subjective decision will necessarily be involved (32).

Following are brief summaries of the structure and status of the national labeling committees formed in Sweden and Norway.

Sweden. In Sweden, the well-established Swedish Standards Institution (SIS) will coordinate the labeling system. An environmental labeling board set up within SIS will consider proposals of product groups for labeling and set up working groups to come up with product specifications. Final decisions will, as previously stated, be made on a Nordic level. Recognized testing institutions will perform the tests to verify that products applying for labels meet the specifications. At its first meeting on February 5, 1990, the Swedish Environmental Labeling Board decided to form expert groups to develop criteria for labeling of paper products, batteries, and detergent.

Norway. Norway has created the Norwegian Foundation for Environmental Product Labeling, composed of a secretariat, board, and council. The secretariat will administer daily activities, while the board will appoint expert groups to define criteria for product groups and handle applications for use of the label; the council will deal with appeals of label applicants and handle budgeting and accounting activities. As of April 1990, the secretariat, board, and council had been established, and an expert group for paper products was being formed (42).

Australia: Green Spot (28)

Australia is preparing to launch a national environmental labeling program known as "Green Spot" later this year. Originally the program was to proceed on a national basis in July 1990, but the start may be delayed due to some unresolved issues.

In response to growing consumer concern about products' environmental impacts, the Victorian Government initiated the Green Spot consumer awareness program in March 1989 to promote environmentally sound products. The first stage of the program involved publication of a series of Green Spot Bulletins, advising consumers how to make environmentally sound purchasing decisions regarding various products. The second stage of the program involved the formation, in May 1989, of an advisory panel to investigate the feasibility of a national environmental labeling program and to make conclusions and recommendations. A final report, published in December 1989, presented proposals for an environmental labeling program's structure, operation, funding, selection of product groups, product criteria and evaluation, and marketing (28). As in other countries' programs, manufacturers' participation would be voluntary, with fees charged for application and for use of the label; licensing agreements would be valid for a limited time period.

The Green Spot program is proposed to identify and label consumer products which are environmentally sound in terms of four broad impacts:

- "They cause substantially less pollution than other comparable products in production, usage and disposal."

- "They are recycled and/or recyclable where comparable products are not."

- "They make a significant contribution to saving non-renewable resources or minimising use of renewable resources compared with other comparable products."

- "They contribute to a reduction of adverse environmental health consequences." (28)

Types of products which are considered universally environmentally benign are not to be included in the labeling program.

Primary environmental criteria will be defined for each product category, addressing the most significant environmental issues associated with that particular product. In addition, the following general environmental criteria will be considered for every product on a "cradle-to-grave" basis:

- "The source of raw materials and the likely impact on the environment in accessing those materials."
- "The energy used for production of a product."
- "The environmental effects of wastes arising from the production process and methods used to dispose of gaseous, liquid or solid wastes. In these respects, product manufacturers must comply with State and Federal environmental regulations."
- "The risk of environmental effects arising from the physical, chemical or biological properties of the product or of its breakdown products."
- "Indication of an established route for acceptable recycling or acceptable disposal of products and any environmental impact of such disposal."
- "Appropriateness of any packaging of the product and its suitability for recycling."
- "The product's capacity for multiple use as opposed to single use and disposal." (28)

In addition to environmental criteria, safety of the product must not be compromised, and issues of price, performance, convenience, and durability may be considered as well.

Draft criteria for four initial product categories have been developed and are to be published for public review. The first four product categories are unbleached paper products, chlorine-free paper products, recycled paper, and products made from recycled plastics. Future product categories may include household cleaning products, batteries, and paints.

U.S. States and Regional Organizations

In the absence of a nationally authorized environmental labeling program in the United States and in response to rising public concern about environmental issues, individual states and regional organizations have begun to attack the issue of "environmental friendliness" on local and regional levels. In the past few years, hundreds of pieces of legislation have been proposed, attempting to reduce the harmful environmental effects of various products or materials.

Legislative efforts have primarily been directed at defining and banning environmentally unacceptable goods, rather than promoting "clean" products. Judgments of whether or not goods are environmentally friendly are usually based on recyclability (either the perceived ability of the material to be recycled in general, or qualified by the local availability of a recycling program), degradability (of plastics), and reusability (returnable, refillable packaging). Some bills begin with broad statements such as "Plastics and foam packaging causes litter and environmental problems because it is not biodegradable or **recyclable**" (89) (emphasis added). Such statements lead one to question the technical research on which the legislation was based.

Perhaps more than any other, the issue of degradability illustrates the extreme differences in perceptions of what is better for the environment. While many states have bills seeking to ban nondegradable plastics (notably the corn belt states, producers of the cornstarch often used to promote biodegradation), many bills have also been introduced to ban degradable plastics because of the lack of information on the identity and effect of products which may be mobilized by the breakdown of the material, and because of the possibility of contamination of plastics recycling operations.

Proposed legislation often does not specify a preferred or optimum substitute material for banned materials, or indicate that the environmental effects of substitute products have been thoroughly considered (92); for example, what are the environmental impacts of repeatedly transporting and washing heavier, reusable glass bottles when substituted for plastic soda bottles?

CONEG (Coalition of Northeastern Governors) has focused its attention on the issue of environmental responsibility in packaging. Its preferred packaging guidelines, in order of preference, are: no packaging; minimal packaging; consumable, returnable, refillable/reusable packaging; and recyclable packaging or recycled material in packaging. Decisions on what amount of packaging is necessary and what can be eliminated can be a subjective decision; however, packaging for consumer convenience and attractiveness is considered to present the greatest opportunity for reduction. In addition to these packaging guidelines, CONEG is also supporting requirements for removal of toxic agents such as lead, cadmium, and mercury from packaging (68).

In March, the Attorneys General of California, Massachusetts, Minnesota, Missouri, New York, Texas, Washington, and Wisconsin held a public forum on environmental marketing in St. Paul, MN. Information on the results of the forum was not available at the time this report was prepared.

The Pennsylvania Resources Council (PRC) is also active in environmental issues relating to consumer products. PRC sponsored an environmental shopping seminar in March of this year. They also publish an environmental shopping guide, which recommends buying items packaged in recycled or recyclable materials or reusable containers, and avoiding mixed material packaging and excessive packaging. PRC recently published a special addendum to this shopping guide, revising its previous recommendation favoring paper bags over plastic. Degradable plastics are not recommended, and reusable cups, plates, etc. are favored over polystyrene. PRC provides a list of brand name items packaged in recycled or recyclable materials, namely glass, aluminum, and paperboard made from recycled paper, and will update the list to include products packaged in recyclable plastic and ferrous metals (7, 8).

The New York Public Interest Research Group (NYPIRG) has put out a pamphlet, "Plagued by Packaging," which is similar to PRC's guide in its recommendations on packaging. Consumers are urged to avoid single-use, disposable items, difficult-to-recycle or non-recyclable packaging, and toxic packaging, and to look for reduced, reused, and recycled products. The pamphlet provides a list of toll-free numbers for manufacturers of offending products and encourages consumers to call and demand corporate action (40).

The most recent entrant into the field of product certification and labeling is Scientific Certification Systems of Sacramento, California, with its "Green Cross" labeling program (19, 29, 52). The program is being supported by the National Toxics Campaign and four West Coast supermarket chains. Two seals of approval will be awarded, one for recycling (product must contain highest possible level of recycled material), and one for overall environmental acceptability (product must be environmentally benign, manufactured in a responsible manner, and free of excess packaging)(19). The group will perform its own product testing and assessment, but will also accept evidence from credible independent testing laboratories. The program is intended to fill the need for a strict independent system to direct consumers toward environmentally preferable products, but critics fear that recommendations may be made on oversimplified evaluations, further misleading and confusing consumers. Labeled products may start appearing in stores before the end of this year.

Environmental Groups

Among environmentalists, enthusiasm for green marketing is particularly high. In an informal telephone survey, when contacted and asked about environmentally friendly products and labeling, many environmental organizations, although not actively involved in such programs, were eager to hear of any developments in this area, particularly regarding the possibility of the beginning of a standardized approach to environmental labeling claims. The widely expressed opinion is that environmental labeling is a great idea and has the potential to make significant environmentally beneficial effects on consumer purchasing decisions, but, with everyone jumping on the green bandwagon, environmental labeling needs to be standardized before it gets completely out of control and consumers lose faith in its integrity.

Many environmental shopping guides are now widely available, as well as "save the world" books that contain product/packaging recommendations among other socially beneficial activities (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 40). Shopping and environmental action guides include books and pamphlets published by various individuals and environmental groups, intended to provide the reader with information to use in making purchasing decisions, investments, lifestyle adjustments, etc. that will have the least negative impact on the environment. Most of these publications do not claim to provide the answer of what is environmentally best, but rather aim to help readers make informed choices or modify their habits in order to minimize waste and pollution and conserve resources.

For the most part, it is difficult to determine the source and extent of technical justification behind the shopping guide recommendations. Many appear to use the simplified "plastics are bad" approach, based on the nondegradability of plastics compared to paper (regardless of studies which show that the actual decomposition rates of paper in sanitary landfills are slow) and the "nonrecyclability" of plastics (or the limited availability of plastics recycling programs). Judgments appear to be based on one or a few criteria, and not on a thorough environmental impact evaluation. Criteria most frequently used are weight or volume contribution to municipal solid waste, recyclability, recycled content, minimized packaging, degradability, elimination or reduction of potentially hazardous or toxic materials, or reduced energy usage. Emphasis is most often exclusively on the solid waste impact of the products without regard for their potential impacts on air, water, or other pollution problems during manufacture, use, or disposal.

The following paragraphs provide a brief summary of shopping/environmental action guides with regard to the following issues:

- Basis on which products are discussed/compared (is an attempt made to rate products on overall environmental acceptability, or are products rated as better or worse on individual environmental impacts?)
- Use of technical data to support recommendations (evidence and source of supporting technical data, evaluation techniques such as cradle-to-grave or single criterion)
- Treatment of sample category (diapers)
- Other evidence of technical research.

Shopping for a Better World.
Council on Economic Priorities (1).

This "socially responsible" shopping guide rates brand name products not on their individual merits, but by their manufacturer's performance in individual categories such as environmental performance, animal testing, charitable contributions, and advancement of women and minorities. The matrix format allows consumers to select products based on a favorable rating in any category or categories of their choice. Environmental criteria are somewhat different depending on the size of the company:

Criteria for large companies (more than 100 employees)
BEST - "Positive programs, such as the use and encouragement of: recycling, alternative energy sources, waste reduction, etc. A record relatively clear of major regulatory violations."
FAIR - "A mixed record: some positive programs such as use and encouragement of recycling, alternative energy sources, waste reduction, etc. Problems such as accidents, regulatory infractions, fines, complaints, etc."
POOR - "Company has consistently poor public record of repeated violations and/or major accidents; or is a

cigarette manufacturer. Relatively little effective positive effort."

Criteria for small companies (100 employees or less)
BEST - "Makes strong effort to: 1) use biodegradable and/or recyclable materials in packaging products, 2) dispose of waste produced in manufacturing process in an environmentally sound way, and 3) use only natural ingredients."
FAIR - "Moderate effort to achieve above."
POOR - "Little or no effort to achieve above."

The section entitled "About the Research" states that "Categories such as Environment and Community Outreach are extremely complex, so that even with substantial information, data were not comparable company to company. The reader should be aware that ratings in these two categories are less precise."

Specific sources of data are not clear, although a disclaimer lists the general sources of information (companies themselves, public information, and advisors). A list of advisors is also included.

The Green Consumer.
John Elkington, Julia Hailes, and Joel Makower. (2)

The book presents two basic considerations for "greenness": environmentally sound contents or environmentally sound packaging. Ideal green products are described as those that:

- "are not dangerous to the health of people or animals"
- "do not cause damage to the environment during manufacture, use, or disposal"
- "do not consume a disproportionate amount of energy and other resources during manufacture, use, or disposal"
- "do not cause unnecessary waste, due either to excessive packaging or to a short useful life"
- "do not involve the unnecessary use of or cruelty to animals"
- "do not use materials derived from threatened species or environments."

In addition, a green product ideally should not trade price, quality, nutrition, or convenience for environmental quality.

The book states its goal as presenting different sides to some controversial issues and letting the consumer make decisions and show support of companies that attempt to improve the environmental quality of their products.

Materials and products are generally evaluated on a single criterion at a time, with no overall summary of environmental pros and cons associated with all environmental impacts of a product.

This book's data and recommendations on diapers are summarized in Table 2-2.

Sources of data and information in tables and charts are identified; other statistics and figures are quoted without source identification.

The Green Consumer's Supermarket Shopping Guide.
John Elkington and Julia Hailes. (3)

Given that the authors also helped write The Green Consumer discussed above, it is not surprising that the definition of a green product is almost identical; however, this book also adds the condition that a green product should not "adversely affect other countries, particularly in the Third World."

The book's stated purpose is to make environmentally friendly choices as clear as possible. It generally considers several (but not nearly all) of a product category's environmental impacts at a time, often presenting the information in matrix form.

Little actual data are presented on diapers; instead, environmental issues such as use of forest resources, chlorine bleaching and resultant pollution and residual dioxin, volume and pollution effects in landfills, and possible recycling of wood pulp from used diapers are mentioned. No final recommendations or conclusions are made.

Sources of data are not usually identified.

50 Simple Things You Can Do To Save The Earth.
The EarthWorks Group. (10)

No attempt is made to define environmentally friendly or clean products.

Very limited discussion of environmental impacts of products; usually concentrates on most visible detrimental effects.

Data and recommendations on diapers are summarized in Table 2-2. Many high-emotional-impact statistics quoted without source identification.

Table 2-2

DATA AND RECOMMENDATIONS ON DIAPERS PRESENTED BY ENVIRONMENTAL GUIDES

Product/Criterion	Green Consumer	50 Simple Things to Save the Earth	How to Make the World a Better Place	750 Ways to Save Our Planet
Regular Disposable Diapers				
% of waste stream	Just under 2%	1% of all landfill vol.	3%	
Untreated fecal matter	2.8 million tons	3 million tons		84 million pounds
Wood pulp/year		1,265,000 metric tons	1,265,000 tons	800,000 tons
Trees/year		> 1 billion	> 21 million	
Paper/year				800 million pounds (nonrecyclable)
Plastic/year	67,500 tons	75,000 metric tons	75,000 metric tons	100,000 tons
Time to decompose (years)	300 - 500	500	200 - 500	500
Cost	$1,533 (30 months)		About $800/year	
Energy required			21 trillion Btu	
Waste produced			6.3 millions pounds (air) 2,700 pounds (water) 13.2 million pounds (solid waste)	
% degradable content	72.3 (Pampers)			
Degradable Diapers				
Time to degrade (years)	2 - 7 (theoretical)		2 - 5	2 - 5 (in laboratory)
% degradable content	92.4% (Nappies)			
Recommended?	May be slightly better than regular disposables	No	Yes, but cloth better	No
Cloth Diapers				
Home cost	$284 (30 months)		20-30 % less than diaper service	$12-50/month less than disposables
Diaper service cost	$975 (30 months)		$400-600/year	
Number of uses	Up to 200	Up to 100		80-200
Time to decompose		1 - 6 months		6 months in landfill

How to Make the World a Better Place.
Jeffrey Hollender. (4)

No attempt is made to define environmentally friendly products. A single-criterion approach is used when discussing environmental impact of products.

Data and recommendations on diapers are summarized in Table 2-2.

Identifies sources of some information and data; refers readers to additional sources.

Save Our Planet - 750 Everyday Ways You Can Help Clean Up The Earth. Diane MacEachern. (5)

Stated purpose of book: "Though this book has not attempted to provide a comprehensive list of 'ecologically correct' consumer products, where particular items or companies stand out as being significantly 'better' or 'worse' than their counterparts, they are mentioned."

Generally focuses on a single, high visibility criterion in analyzing products.

Data and recommendations on diapers are summarized in Table 2-2.

Quotes some sources of information and directs readers to others.

In summary, environmental books appear to use a single-criterion approach to evaluating products. None of these books attempted even a simplified life cycle analysis. When more than a single criterion is used, the presentation of data is often one-sided. Data on a single topic may vary considerably from book to book depending on its source. In all fairness, most guides do not claim to provide the answer of what is environmentally best from a comprehensive standpoint but rather provide limited data for the consumer to use in making purchase decisions.

Private Organizations (Companies, Supermarkets, etc.)

Naturally, many manufacturers are eager to respond to the rising tide of environmental concern by labeling their products "environmentally friendly," "better for the environment," etc. Many manufacturers are sponsoring evaluations of the environmental implications of their products, often performed by independent research groups (17, 30, 71, 74). The results of these evaluations may be published in a private report, in an informational pamphlet for general release, or as an advertisement in a trade journal or popular publication. It is interesting to note, however, that some manufacturers are still hesitant to advertise products' recycled content out of concern that the customer might perceive them as inferior in quality to products made of virgin material. In particular, this was mentioned as a concern regarding consumers' perceptions of sanitary paper products (31).

In general, however, manufacturers have been putting more emphasis on promoting the environmental benefits of their products, as evidenced by the ever-increasing number and size of environmental ads in trade journals and popular publications. It is not easy for the consumer to tell whether these claims have been backed up with investments in more environmentally sound manufacturing processes and equipment, more environmentally benign ingredients, more environmentally acceptable packaging, etc.

Manufacturers' environmental labels typically are based on a single environmental criterion, providing no clue as to whether any other environmental impacts were considered in making their advertising claim. Common criteria for labeling claims are those with high public interest or visibility, such as recycled content, degradability, and lack of CFCs in content or manufacture.

Some grocery and retail stores are addressing their customers' environmental concerns by stocking more products which have been labeled "green" by their manufacturers or providing their own "green" lines, supplying shoppers with environmental shopping guidelines, providing drop-off points for recyclable materials, and promoting paper bags and reuse of shopping bags (26, 46, 52, 56, 61). Customer response to the paper shopping bag campaign at Big Bear markets in California has been enthusiastically positive. Big Bear's advertising contains the following justification for the promotion of paper bags (made from 38 percent recycled paper):

> "One of the most pressing local environmental concerns is the rapid depletion of landfill in which to dispose of our waste. The use of plastics is a major contributor to this problem. Most plastics are difficult to recycle and do not easily break down and become absorbed in a natural environment. They can also create serious marine pollution. But paper, as litter, breaks down easily and appears to be less harmful to wildlife, fish, and game." (61)

A senior scientist at the National Audubon Society agrees that paper bags are a better environmental choice in locations near a coastline where the bag might end up in water, but advises that otherwise plastic shopping bags, which are lighter and cause less pollution per pound, are the preferred choice. The chain continues to provide photodegradable plastic bags upon request.

In addition, the stores' environmental campaign includes substitution of paper containers for foam in the store deli, CFC-free meat containers, and requests to suppliers to package their products in environmentally safer packaging, such as pulp egg cartons instead of foam. Big Bear also provides shelf tags with guidelines to help shoppers select environmentally preferable products based on recommendations by San Diego's Environmental Health Coalition.

PRODUCTS FOR WHICH CRITERIA/METHODOLOGIES HAVE BEEN DEVELOPED

As mentioned in previous sections, 57 product categories have been defined for environmental labeling in West Germany, and product category guidelines have been approved or proposed for a total of 16 product areas in Canada.

In these programs, criteria have been developed for the various product groups. These groups have been selected for one or more of the reasons listed below, each of which is discussed with examples given.

1. The product is a major constituent of the waste stream by volume or weight. Products which have been selected for this reason include recycled paper and plastic products, recycled glass, and cloth diapers as a substitute for disposables.

2. The product has a significant impact on the waste stream due to toxicity, disposal problems, etc. Products in this category include motor oil, batteries, asbestos-free automotive products, and PCB-free cooling and insulating liquids for electrical appliances.

3. Product use provides a substantial environmental benefit. Canada recently withdrew its proposed guideline for recycled rubber products because the environmental benefits of rubber recycling were not considered adequate to justify the energy consumption of the recycling process (20).

4. The product meets overall safety and quality requirements for normal use. As stated above, it has been reported that there were some performance problems with acrylic paints labeled under the Blue Angel program, and as a result, a consumer quality testing organization has been included in the

product evaluation process (11). Canadian guidelines specify that each product must meet or exceed all applicable Canadian governmental and industrial safety and performance standards.

5. Product requirement levels for the label are high in order to challenge industry to meet or exceed the current levels of clean technology (25). This includes periodic review and revision of requirements, such as the recent raising of the required recycled content of Blue Angel-labeled paper products from 51 to 100 percent (11).

6. The product is easy to evaluate. Although existing programs claim a cradle-to-grave approach in evaluating products, usually products are differentiated on the basis of a few well-defined or easily determined criteria.

7. The product is commonly used. Even though a product is commonly used, there is not much point in going through the expensive and time-consuming procedures of setting criteria and evaluating products if there will be no significant impact on the environment as a result.

8. The product does not shift environmental impacts from one area only to create problems in another (25). For example, an increase in recycled paper content should not result in increased water pollution due to the bleaching and deinking of recycled fiber. Use of a life cycle approach to product assessment avoids overlooking shifts in environmental impact.

In addition to the above, the West German program considers the following requirements (25):

- The product must already be on the market. If an environmentally preferable product is new, with no competing products, it is not considered to need a label to boost its market share.

- There must be a need to promote the product - the environmental label should not be awarded to product categories with too large a market share.

- All products in competition with one another because of their sphere of use must be included.

It is important that this last consideration be kept in mind when deciding whether or not to label a product based on its market share. Otherwise, consumer confusion may result. As previously mentioned, the West German program has been criticized for its failure to label water-based dispersion paints while low-solvent paints considered more environmentally damaging are eligible for the label. Because water-based paints are not suitable for all applications in which low-solvent paints are used, and because water-based paints already dominate the market in the applications for which they are suitable, labeling of water-based paints was not considered necessary (32). This seems at least somewhat in violation of the "include all competitive products" requirement, and undoubtedly has confused some shoppers.

As another example, if only non-CFC aerosol personal care products are labeled, a consumer shopping for deodorant may find himself faced with an aerosol spray, a liquid roll-on, and a solid stick applicator, with only the aerosol bearing an environmental label. Does the consumer interpret this to mean that use of the aerosol is better for the environment than the roll-on or stick versions with no chemical propellants and less packaging volume? The purpose of "clean" labeling is to aid the consumer in making environmentally beneficial decisions, rather than misleading or confusing him; unfortunately, accomplishing this effectively is one of the major challenges of such a program.

Chapter 3

CRITERIA THAT HAVE BEEN USED TO EVALUATE PRODUCTS

In this chapter, criteria that have been used to evaluate "environmentally friendly" or "clean" products are discussed. Primary emphasis is placed on consumer products, although the same criteria can apply to most products or processes. Most "clean products" recommendations are based on one or a few of these criteria rather than a total environmental impact evaluation.

RECYCLED CONTENT

Recycled content is the most popular and widespread criterion used to classify products as environmentally friendly. It is used by nationally-regulated labeling programs, manufacturers, and political, legislative, and environmental groups. It is a popular criterion because of wide recognition and support by consumers; however, different groups may use different definitions or requirements for recycled content, depending on their definitions and percentage requirements of postconsumer material. (Generally, postconsumer material includes only that which has passed through end usage as a consumer item; it does not include scrap and waste associated with manufacturing operations, such as cutting and printing.) The Canadian guidelines for recycled paper and plastic products contain the working definition of postconsumer material and specify the amount that must be present in each product subcategory (15).

Products in the German and Canadian programs that use recycled content as a major criterion include various paper products (sanitary paper, wallpaper, construction materials, cardboard, fine paper, newsprint, and miscellaneous products including craft forms) and recycled plastic products.

RECYCLABILITY/REUSABILITY

In the United States, recyclability and reusability are widely used as criteria in legislation for banning environmentally "unfriendly" materials, although definitions may vary somewhat from place to place. For example, recent proposals in Massachusetts and Oregon to ban environmentally unacceptable packaging differed in their definitions of recyclable. In

Massachusetts, a recyclable package is one made of a material that will have achieved a recycling rate in the state of at least 35 percent before the year 2000, and 50 percent after that. Oregon defines both recyclable packages and packages made of recyclable materials. The former is defined as one that is itself included in an effective recycling program, while the latter includes packaging made of materials that are effectively recycled in Oregon. "Effective recycling" means a 15% recycling rate by 1993, 30% by 1996, 45% by 1999, and 60% by 2002.

Obviously, standard definitions of terms would be a step in the right direction. In addition, proposed legislation is not specific on the materials or containers that are to replace those deemed unacceptable; increases in volume, weight, and energy usage in production or transportation which may result from substituting traditional recyclable materials such as glass or paper for plastics are not addressed.

Canada's guideline for reusable cloth diapers specifies that the diaper must be able to endure a minimum of 75 uses and must not include a non-reusable component. Canada's Environmental Choice program also has issued a draft guideline for reusable shopping bags (15).

Recyclable/reusable products labeled with the West German Blue Angel include reusable capsules for whipped cream makers and soda siphons, reusable drop boxes for food, reusable packings for transportation, reusable trays and industrial packaging, reusable or refillable typewriter ribbon cassettes and toner cartridges, recyclable printed material, and returnable glass bottles (also collection bins for glass).

DEGRADABILITY

Degradability is an extremely popular and widely disputed criterion for environmental friendliness. It has been heavily used as an advertising point, but is currently being questioned or even denounced by many environmentalists. Many manufacturers and retailers focus on degradability as a positive characteristic, especially in the great war of "plastic versus paper"; however, at least one "environmentally conscious" mail order company has temporarily withdrawn its biodegradable plastic bags for re-evaluation of their environmental effects (49), and several companies have indicated that they will no longer market their plastic bags as biodegradable or photodegradable (35). Some legislative proposals have called for bans on nondegradable plastics, while others have attempted to eliminate degradables. Arguments for degradability include permanence of nondegradable plastic waste in landfills or as litter, breakdown of degradable plastics into harmless byproducts, and benefits to composting programs by eliminating the need to separate bags from yard waste (63, 71).

Arguments against degradability include contamination of plastics recycling systems, lack of knowledge about decomposition products and their effects on soil and groundwater, encouraging the throwaway mentality, and contributing to loss of nonrenewable petroleum resources. Degradability also focuses attention away from real waste solutions such as source reduction and increased recycling (66, 71, 78, 79, 83). It is interesting to note that neither the Canadian nor West German environmental labeling program has any product categories based on degradability.

Degradability continues to be used by some manufacturers and retailers as a key advertising point for disposable diapers, plastic bags, and virtually any other application where paper and plastic may compete, such as in packaging. An additional problem is the lack of definition or consistent definition of conditions under which degradability is to be measured, time intervals for specific levels of decomposition, identity of decomposition products and determination of their environmental effects, and definition of similar issues for substitute products.

HAZARDOUS/TOXIC MATERIAL CONTENT

This criterion can be used as justification for the necessity of environmental labeling of a product category, or can be used to disqualify products from eligibility for labeling, as in the case of West German aerosol products, where non-CFC aerosol products were not considered if they contained harmful substances (23). Of course, the term "harmful" (or even "toxic") also requires definition for its use to be meaningful.

Reduction or elimination of toxic materials or substitution of a more benign substance has been the primary criterion for "environmentally friendly" product categories such as zinc-air batteries; lithium batteries free of mercury and cadmium; asbestos-free floor coverings, brake linings, and clutch linings; corrosion protection coatings low in lead and chromates; PCB-free cooling and insulating liquids for electrical appliances; and low formaldehyde products from wooden material, all labeled under the West German program.

WATER POLLUTION IMPACTS

Water pollution has not been an obvious major criterion in either the Canadian or West German labeling programs, although it is given specific attention in several environmental guides, particularly those having to do with phosphates and bleaches in detergents and biodegradability of various household cleaning products (2, 3, 5, 10). Of course, the pollution of water, air, and soil associated with all stages of a product's life cycle must be considered in a true cradle-to-grave analysis, but it is questionable how much attention is given to these matters in evaluating a product's environmental friendliness, other than assuring that emissions do not exceed regulatory limits.

SOIL POLLUTION IMPACTS

This is another criterion that is an integral part of a cradle-to-grave analysis but is not a popular single criterion for labeling or a strong advertising point, except perhaps in the case of organically grown foods (3). Here advertising is usually focused on health, rather than environmental, benefits.

Soil pollution is given secondary attention as an issue associated with the disposal of batteries and resultant leaching of heavy metals, and the concern about the effect of fecal wastes in disposable diapers (2, 4, 5, 10). It is also being mentioned more frequently as a concern in the issue of degradable plastics, due to lack of knowledge about the identity and effect of degradation products (2, 66, 78, 83).

AIR POLLUTION IMPACTS

By far, the most popular air pollution issue in the past few years has been the CFC content or "ozone friendliness," which has been covered by labeling programs (both national and individual manufacturers' own), environmental shopping guidelines, and proposed legislation, particularly with regard to foam plastics production and content.

Air pollution effects are also used as a criterion when discussing disposal of products by incineration. Claims are often made about the likelihood of toxic substances being produced or released by the incineration of plastics (2, 3, 4, 5).

Labeled products with air pollution as the primary criterion include non-CFC aerosols, low-emission burners, motor vehicles with exhaust treatment, and public transportation tickets (when public transportation is used, auto emissions are reduced because fewer individuals operate private vehicles).

NOISE POLLUTION IMPACTS

This criterion is little used in the United States; however, it has been used as the primary criterion in labeling West German products in the categories of lawn mowers, car mufflers, soundproofed glass collection bins, mopeds, construction machines, and garden chaff cutters. Judging from the types of products to which this criterion has been applied, it appears that noise pollution is only used as a criterion associated with use of the completed product. It is hard to imagine how a life cycle noise pollution analysis could be performed. Other environmental pollution impacts such as air, water, and soil pollution would seem to be more environmentally significant, as well as more easily tracked and quantified over a product's life cycle.

PRODUCTION PROCESSES USED

The draft issues of the Canadian Environmental Choice guidelines for re-refined oil and recycled cellulose construction materials specified acceptable processes for oil demetallization and hydrotreating and for use of a dry process to produce recycled paper products. These specifications were removed from the final approved and officially issued guidelines (15). The reason for this is not yet known.

USE OF RESOURCES (INCLUDING ENERGY)

This criterion can be subdivided into use of energy and use of raw materials and resources.

Unless energy usage is the primary evaluation criterion, it is hard to tell whether it has been addressed in assessing the product's environmental impact. Cradle-to-grave energy consumption is rarely mentioned when comparing plastic to paper bags, although a German study showed that polyethylene bags are more advantageous than paper bags in terms of energy usage (67). In addition, it is difficult to determine whether the increased energy usage for collection, transportation, cleaning, and distribution of reusable products such as refillable glass bottles has been considered by legislative bodies seeking to ban nonreusable, nondegradable, or nonrecyclable materials (92).

Energy-conserving products that are covered by West German or Canadian environmental labels include energy efficient appliances, heat recovery ventilators, solar power operated products and mechanical watches, and highly insulating window glass.

Product recommendations on the basis of resource conservation are most often directed at plastics as a user of petroleum, considered a non-renewable resource, and paper as a user of wood, considered a renewable resource. Products such as fast-food beef and exotic woods, associated with rainforest destruction, are also considered users of non-renewable resources. Water conservation also shows up as an issue in German-labeled products.

Product categories that have been deemed environmentally better based on resource usage include water-conserving car washes, water-saving flush tanks, flow restrictors and pressurized flushers, and low-waste personal care products.

OTHER CRITERIA

Various other criteria that have been used less extensively to judge a product or material's "environmental friendliness" are listed below.

Use of More Benign Products/Processes

An example of this is the West German product category "thermal processes (using hot air) to combat xylophagous [wood-boring] insects."

General Requirement of Safety, Usability

This is stated as part of the charter of the West German Blue Angel program and is specifically stated as a requirement in each of the Canadian Environmental Choice guidelines.

Amount or Type of Packaging

Packaging is an area widely targeted by environmental groups in shopping recommendations. Consumers are advised to look for minimal packaging, easily recyclable packaging, or packages with recycled content (2, 3, 4, 5, 7, 8, 10, 40). Manufacturers advertise the environmental benefits of their products with reduced packaging, such as juice concentrates and concentrated fabric softeners (29, 34, 45, 47).

Provision of Information for the Consumer

The Canadian guideline for paint requires manufacturers to provide information on environmentally responsible methods of disposal of the product (15).

Overall Corporate Reputation

The Council on Economic Priorities' booklet "Shopping for a Better World" (1) rates brand-name products not on their individual merits but on their manufacturer's performance in areas including environmental performance, animal testing, charitable contributions, and advancement of women and minorities.

Effect on Rainforest

Environmental action books and shopping guides frequently address this issue, usually advising consumers to avoid fast-food beef (grazed on deforested land) and products made of exotic woods, and encouraging purchase of products that favor rain forest preservation, such as cashews and brazil nuts, which are not easily grown outside the rain forest (2, 3, 4, 5, 10).

Longer Lasting or Repairable Products

Another criterion frequently recommended in shopping guides as an environmentally preferable characteristic is durability or repairability. This contributes to source reduction by preventing products from entering the waste stream by prolonging their useful life.

Weight or Volume Contribution to Landfills or Waste Streams

This, combined with nondegradability and "nonrecyclability," is one of the major criteria used against plastics and packaging in general.

Disposal Problems

Judgments and recommendations made on this issue involve perceptions and beliefs on nondegradability, toxic emissions when products are incinerated, and the environmental effects of improper disposal techniques such as littering and disposal of household hazardous wastes in sanitary landfills. Disposal problems are often used as an argument against plastics in general, particularly concerning effects of plastic litter on wildlife (2, 4, 5, 10, 61).

Chapter 4

METHODOLOGIES THAT HAVE BEEN USED TO EVALUATE PRODUCTS

PRODUCT LIFE CYCLE ANALYSIS

Environmental problems potentially can be alleviated by either direct or indirect means. A direct means would include bans or economic incentives or disincentives (such as taxes or grants) which have an immediate or direct effect. For example, if a battery contains a toxic fluid or metal, the banning of the particular product from disposal sites would prevent it from contaminating a landfill or incinerator. Source separation for recycling purposes is another example of a direct means of alleviating the identified environmental problem of filling up landfills; however, the alternative to disposal will create impacts of a different kind.

Examples of indirect means include the banning of a product (or discouraging or encouraging its use by incentives or disincentives), or the substitution of one product for another in order to correct some problem not as clearly linked to the product. For example, the environmental problem of carbon dioxide in the atmosphere and its possible role in global warming can be addressed by the banning of a product or products that are thought to be responsible for large amounts of carbon dioxide emissions during their manufacture. In this case the linking of carbon dioxide production with a consumer product is inferred.

For example, consider the burning of coal (which results in carbon dioxide) to produce electricity to manufacture a packaging product. The banning of the product may or may not result in reduction of electricity usage. The utility may undertake marketing strategies to replace any lost sales and continue to produce as much carbon dioxide as before the product was banned. It is not certain that reduced product use will result in less carbon dioxide, since the indirect process may simply be used for something else and continue to produce carbon dioxide. Therefore, it is not nearly as clear that benefit will result from any indirect action taken as it is from direct action, nor is the magnitude of the benefit as easily determined.

The worth of either a direct or an indirect approach can only be assessed by a life cycle analysis which examines the entire complex of operations associated with a product. The theory is that consumption of products drives an array of extraction, manufacturing, processing, transportation, and disposal operations. Figure 4-1 illustrates the life cycle approach, using soft drink packaging as an example. Products begin their "life" with the extraction of raw materials, which includes operations such as mining minerals and drilling for oil and gas. These materials are then transported to other locations for processing and for manufacture into finished materials. Typically, these materials are then fashioned into products at still other locations.

Eventually these products are purchased by wholesalers, then by retailers and, finally, by consumers. After use, the products are then discarded and go to final disposal or are recovered for recycling. For each step and for transportation between steps there are natural resource requirements, as well as outputs to the environment in the form of air pollutants, water pollutants, and solid waste. All of these steps produce negative environmental consequences.

The theory behind the use of product substitution or banning as a means for environmental benefit is that if the product is not purchased, then the manufacturing and processing will cease and, along with it, the environmental consequences will cease. However, the substitute product also produces environmental consequences that need to be evaluated.

A specific product example of Figure 4-1 is shown as Figure 4-2. The example product is plastic soft drink bottles. The life cycle analysis begins with the extraction of natural gas and crude oil from the ground to serve as the raw material. Additional oil and gas are required as the energy for the various processes and for transportation. Coal must also be mined to produce electric power and to serve as a minor energy source for other processes.

The raw materials are processed and transported to other stages of manufacture until the bottle is finally ready to be filled with product, shipped to retail establishments, and finally used by the end consumers. The bottle "life" ends with final disposal, or the bottle is returned for processing and remanufacture through recycling.

Natural Resources

Natural resources are consumed in each step, and energy is required for any process or transportation. Other natural

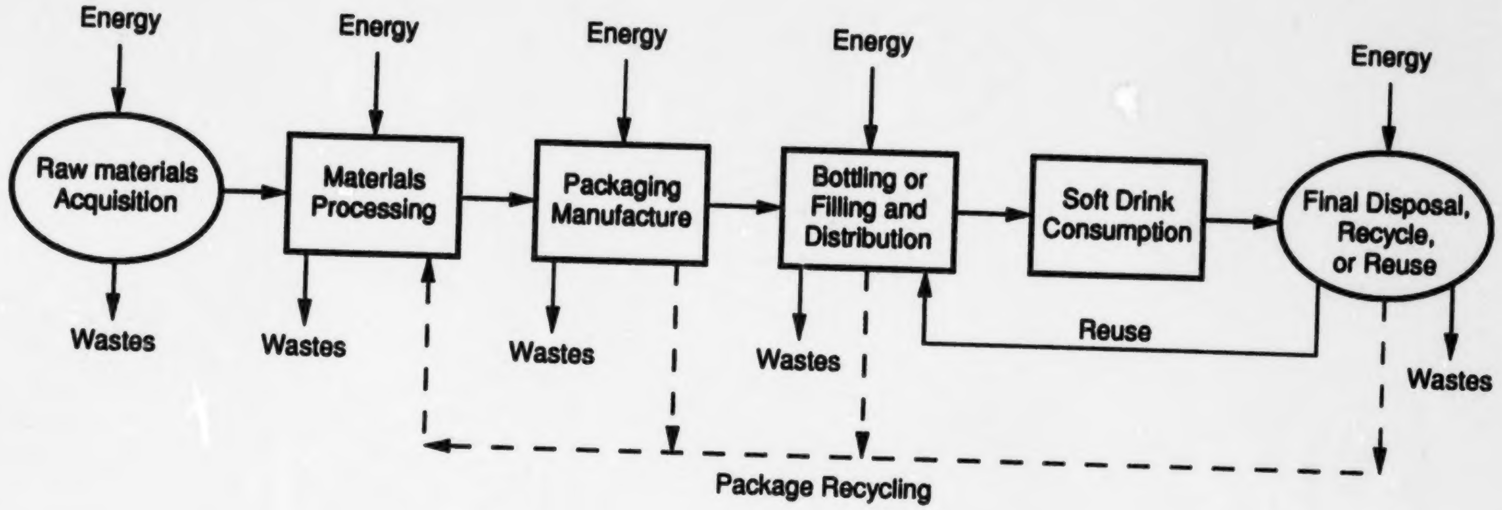
Energy
Energy
Energy
Energy
Energy
Raw materials Acquisition
Materials Processing
Packaging Manufacture
Bottling or Filling and Distribution
Soft Drink Consumption
Final Disposal, Recycle, or Reuse
Wastes
Wastes
Wastes
Wastes
Reuse
Wastes
Package Recycling

Figure 4-1. General materials flow for "cradle-to-grave" analysis of soft drink distribution system.

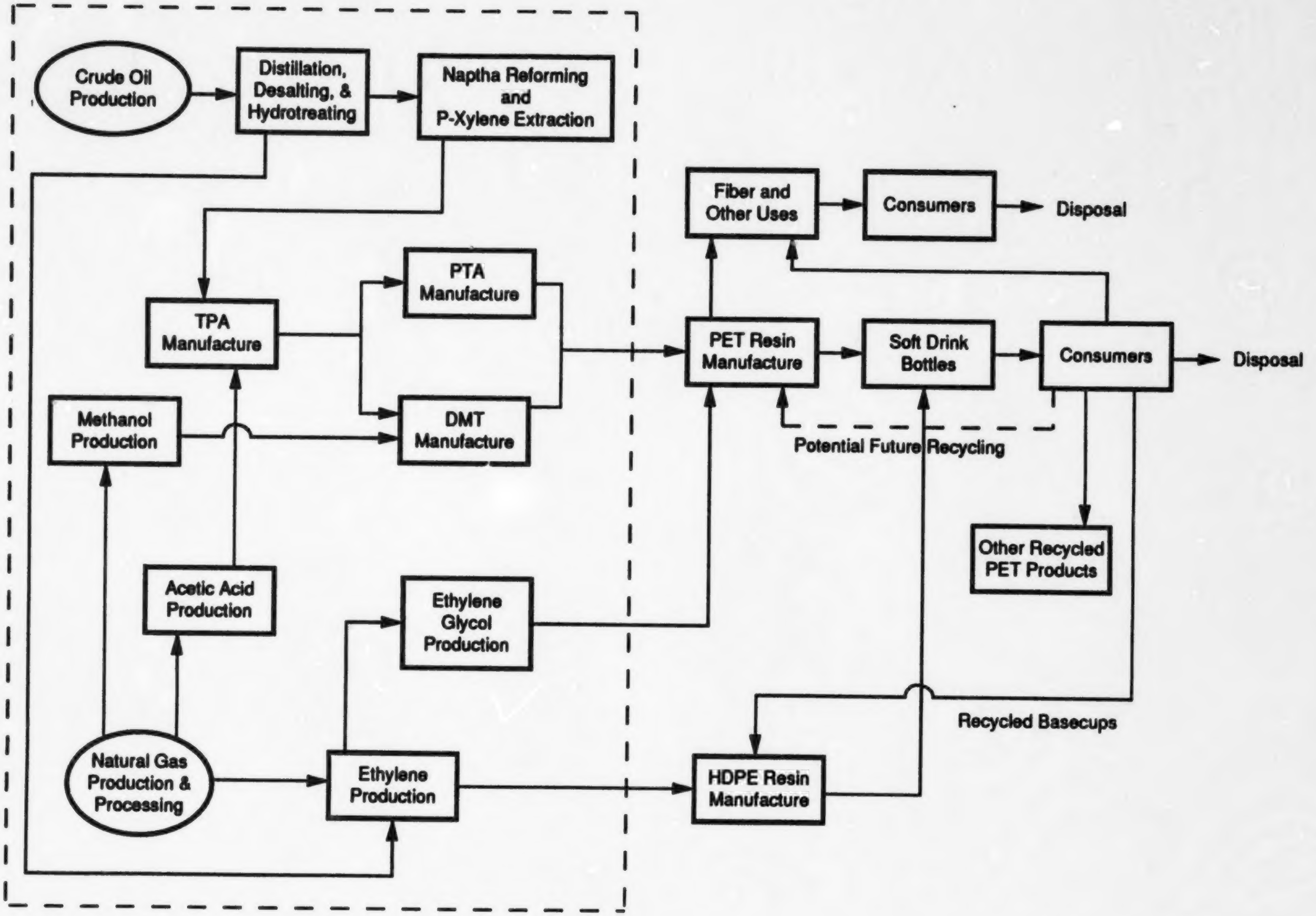
Crude Oil Production
Distillation, Desalting, & Hydrotreating
Naptha Reforming and P-Xylene Extraction
TPA Manufacture
PTA Manufacture
DMT Manufacture
Methanol Production
Acetic Acid Production
Ethylene Glycol Production
Natural Gas Production & Processing
Ethylene Production
Fiber and Other Uses
Consumers
Disposal
PET Resin Manufacture
Soft Drink Bottles
Consumers
Disposal
Potential Future Recycling
Other Recycled PET Products
Recycled Basecups
HDPE Resin Manufacture

Figure 4-2. Summary diagram for the production and recycling of PET soft drink containers. (Savings due to recycling are observed in those processes inside the dotted lines.)

resources in the form of minerals removed from the earth or harvested resources such as wood or corn are needed to meet the material requirements for the bottle itself as well as for painting and decorating, labels, packaging, and for many other purposes required to make the bottle a successful product. Water is also required at every point.

The life cycle product analysis includes aggregating the natural resource requirements of every step. For the example given here, the product unit chosen for analysis is 1,000 gallons of beverage delivered to the consumer. For that product unit, Table 4-1 shows the energy requirements in terms of total Btu as well as the Btu by fuel type. These values result from summing the energy requirements for each process in the system as shown in Figure 4-2. The other natural resources can also be summarized for comparative purposes, although this is not shown here.

One important question is how to ensure that all pertinent information is considered. For example, what about the resources expended in manufacturing the steel frames used in trucks that haul the bottles? Such questions must be researched in each instance.

Table 4-1

ENERGY PROFILES FOR THE DELIVERY OF 1,000 GALLONS OF SOFT DRINK IN 2-LITER PET PLASTIC CONTAINERS, 1987 (million Btu per 1,000 gallons)

Natural gas	6.5
Petroleum	7.5
Coal	3.8
Hydropower	0.2
Nuclear	1.3
Wood	0.7
TOTAL	20.0

An important general finding is that a truck hauls literally tens or hundreds of thousands of tons of cargo over its lifetime, so that impacts allocated to any one load are extremely small compared to others. In other words, manufacturing systems not directly required by the bottle system alone are likely not creating significant impacts when compared to the "mainstream" processes. However, these assumptions need to be checked in every case. The criterion is that potential impacts can be ignored only if their contribution is clearly insignificant to the final total impact for the entire system.

Environmental Impacts

For each part of the system shown in Figure 4-2, air and water pollutant discharges were researched and reported in pounds per 1,000 gallons of beverage. For example, the pounds of sulfur oxides discharged to the air from power plants are included to the extent that the allocated power from that plant was used for the product system. Only pollutants discharged to the environment after pollution controls have been applied are measured. Residues such as sludges or solids remaining after pollution control are also included. Solid wastes are included in terms of both pounds and in terms of the cubic yards of volume occupied.

As with the natural resources, these values may now be summed to arrive at an overview for the 1,000 gallon product unit system.

Life Cycle Analysis

The life cycle analysis is useful as a comparative tool. The numbers presented in Table 4-1 are not meaningful in themselves, but need to be compared to others. Table 4-2 shows a life cycle energy consumption of plastic beverage bottles

Table 4-2

ENERGY CONSUMPTION ASSOCIATED WITH THE DELIVERY OF 1,000 GALLONS OF SOFT DRINK IN ALL PET, ALUMINUM, AND GLASS CONTAINERS AT VARIOUS RECYCLING RATES (Million Btu per 1,000 gallons)

	Recycling Rates				
	Virgin System 0%	25%	50%	75%	Recycled System 100%
PET (plastic)	21	20	18	16	15
Aluminum	50	41	33	24	16
Glass	49	42	35	28	21

compared to other containers. In this comparison, it is clear that plastic bottles require much less energy than aluminum and glass at zero percent recycling, but they require only slightly less energy than aluminum at 100 percent recycling.

A critical point here is what conclusions can be reached from this table. Under example recycling rates of 20 percent for plastic, 50 percent for aluminum, and 10 percent for glass, Table 4-3 shows that plastic bottles require substantially less energy than other containers. Does this mean that only plastic containers should be allowed? Should they be substituted for all other containers? Most would agree that this table is not sufficient for decision making of that type for several reasons.

Table 4-3

ENERGY CONSUMPTION OF CONTAINER SYSTEMS AT EXAMPLE RECYCLING RATES (Million Btu per 1,000 gallons)

	Recycling Rate	Energy
PET Plastic (all sizes)	20%	20
Aluminum cans (12 fl oz)	50%	33
Glass bottles	10%	46

Source: Table 4-2

One reason is that energy is not the only important issue. Other important issues include solid waste and air and water pollution. Other natural resource issues may also be relevant, such as depletion of fossil reserves, cutting of forests, or use of scarce water supplies. In the life cycle analysis, each of these factors can be addressed separately, but the question of the weighting of factors arises. For example, if one system is better on energy but worse on solid waste, how do you weight these two factors? At present there is no scientific methodology to decide whether energy or solid waste is more important. The problem of weighting also exists within a single environmental category. If you measure air pollutants, such as carbon monoxide or ozone in pounds, how do you compare one pound of each? Which is worse or better?

Another issue that arises with life cycle analysis decisions is that the favored or encouraged substitute system precludes improvements in other systems or potential new systems in the marketplace. For example, glass bottles are lighter in 1990 than they were in 1970, thus resulting in less solid waste, less energy, and so on for a given bottle. If they had been banned in 1970, those improvements would have never been made. It is also possible that if their competitors had been banned, the lack of competitive pressure may have prevented these improvements. Either way, the results may not have been as favorable in the long term.

Other issues associated with the decision making are economics, employment, and social issues. Product substitution will result in economic and social dislocations if a plant is closed at one location, and another opened for the favored product at another location. However, many of these issues are societal and subjective in nature, and do not lend themselves to scientific, objective analysis in the same way as the impacts previously described.

It appears that when focusing on a single issue, such as energy or nonhazardous municipal solid waste, only a life cycle analysis can provide information on the broad range of direct and indirect consequences. This is because of the complexity of operations involved in the manufacture, use, and disposal of any product. A narrow focus analysis can greatly err in assessing the actual impact of any action that affects purchasing habits.

However, in the complex arena of comparing a given product or a set of products on two or more environmental issues, the technical power of life cycle analysis may not be enough to give adequate guidance. The reason for this is that there are no analytical weighting factors that tell how to compare environmental impacts of one pound of toxic heavy metal sludge to one gallon of water usage or consumption of one Btu of energy. While there are analytical risk assessment techniques which can be applied to these issues, many consider them controversial and subjective. Judgments are still being made, but primarily in the political arena without any technically defensible basis.

Application of Life Cycle Analysis

The use of this type of analysis has been widely accepted as a planning tool to determine objective environmental parameters associated with product manufacture and use. Table 4-4 is a list of generalized categories that cover in excess of 100 specific studies performed since 1969. However, most of these studies have been privately funded and are not generally available to the public.

Table 4-4

LIST OF KNOWN LIFE CYCLE ANALYSES

- Soft drink bottles and cans*
- Juice containers
- Milk containers
- Children's diapers
- Detergent boxes and bottles
- Grocery sacks
- Fast food packaging
- All major categories of plastic products and their alternatives (energy only)*
- Wind energy systems
- Common disposable household products*
- Recycling of common materials
- Food production systems

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*studies generally available to the public

MATRIX APPROACH (Pass/Fail)

While the life cycle analysis approach just described is the most comprehensive methodology for evaluating products, yielding quantitative results, a more common approach is use of a matrix with "yes/no" or "pass/fail" ratings. For example, a widely used book in England (The Green Consumer's Supermarket Shopping Guide [3]) presents a table listing a variety of packaging materials (plastic bags, glass bottles, etc.) with a series of environmental criteria (recyclable? degradable? etc.) with yes/no answers and some comments. Other products are treated in the same manner. For the most part, no quantitative information is provided in this type of analysis.

WEIGHTING SYSTEMS

A problem with either the life cycle analysis approach or the matrix approach is that decisions as to which criteria are most important are left to the reader or consumer of the product. For example, two products (say aluminum cans and glass bottles) can be compared using a life cycle analysis. One product may "win" based on air pollution impacts and the other may "win" based on the amount of solid waste to be disposed. Which is more important, cleaner air or minimizing solid waste disposal?

In the 1970s, when the life cycle analysis methodology was being developed by EPA and others, some attempts were made to devise a weighting system for comparing impacts. (Hunt, R.G. et al., Resource and Environmental Profile Analysis of Nine Beverage Container Alternatives. Midwest Research Institute for the U.S. Environmental Protection Agency. 1974.) Because of the difficulties encountered, the effort was abandoned. The renewed interest in evaluating products will probably lead to new attempts to weight the various criteria. It has been reported that Canada is working on a rating system (11, 23), but details are not yet available.

There may be some useful precedents in hazardous waste minimization programs. EPA's Waste Minimization Opportunity Assessment Manual (82) includes as an option a Weighted Sum Method for screening and ranking waste minimization options. The manual does not, however, provide any guidance as to which criteria should receive higher or lower rankings.

Chapter 5

ISSUES/TECHNICAL PROBLEMS TO BE RESOLVED

This chapter will summarize problematic or controversial issues discussed in previous chapters and present some of the various concerns associated with each.

SELECTION OF PRODUCTS TO BE EVALUATED

The purpose of product evaluation is twofold: 1) to identify products which are less damaging to the environment or offer an opportunity to decrease harmful environmental impacts and 2) to encourage actions that minimize environmental damage and encourage further development of clean technology and clean products. It is necessary to keep these points in mind when selecting products to be evaluated. Following are discussions of several of the criteria used in product selection that may be somewhat vague or controversial.

Products That Are A Significant Factor in the Waste Stream

The key issue here is definition of the term "significant." Products may be considered significant due to:

- Large weight or volume contribution to waste (includes contributions to air, water, and soil pollution, and consumption of landfill space)
- Hazardous or toxic content
- High potential for improper disposal (such as littering)
- Mobility in the environment, particularly of hazardous materials

Significance should not automatically be assumed based on the cost of the product to the consumer or the cost to the manufacturer to make the product environmentally acceptable. The cost to the **environment** is the key issue. Environmentally acceptable products may cost somewhat more if the manufacturing process has to be redesigned or new equipment purchased, or may cost less, if environmentally acceptable manufacturing causes the manufacturer to identify and reduce sources of waste.

Products That Are Simplest To Do Are Often Done First

The problems here may arise from oversimplification of criteria used to assess products, or the selection of products which may be easily and accurately evaluated but do not have a significant effect because of low environmental impact, low sales, lack of consumer support, or other reasons.

In starting up an environmental labeling program, for example, the tendency is to choose easily evaluated products in order to gain experience and introduce the program without long delays (25, 32). This is fine as long as criteria and judgments are not oversimplified. For example, products made from recycled paper must not be judged solely on recycled content. As thorough an attempt as possible should be made to assess the product's entire life cycle, cradle to grave, and at the least, assure that minimum environmental standards are being met everywhere in the life cycle.

Ideally, each stage of the life cycle would be thoroughly evaluated quantitatively for all its environmental impacts, including resource and energy usage, air, soil, and water pollution. Until suitable methodologies are developed for comparison of different environmental impacts, however, it should at least be assured that an improvement in the selected area has not resulted in an environmentally damaging shift in another area. If this is not verified, there may be no net environmental improvement associated with a product, and possibly increased harm.

For the second scenario above, consider a theoretical product manufactured by only a few companies, with a single manufacturing process used by all manufacturers, involving the same resources and raw materials. It would be relatively easy to conduct a thorough life cycle analysis on each manufacturer's version of the product and compare them. But suppose sales of the product are typically low, the product has no toxic content or emissions associated with its use, and the container is recyclable or reusable. Little would appear to be gained environmentally by labeling this product.

Whether To Include Hazardous Products

There are two schools of thought on this issue: 1) products containing hazardous materials are environmentally damaging, regardless of minor differences among brands, and should not be called "clean products" in any instance, and 2) because products containing hazardous materials are environmentally damaging, it is important that the least damaging be identified and promoted to minimize the negative impact on the environment. Both of these approaches have been used.

West Germany chose to exclude products containing harmful materials from its labeled category for non-CFC aerosols, thus excluding products such as some household cleaners (23). What options would a consumer have if he or she wished to purchase an oven cleaner and found none with an environmental label? Possible reactions include a) assume no significant environmental difference among brands and select any one, b) read the labels to try to determine which ones are least harmful, or at least do not contain CFCs, c) assume all must be bad for the environment, purchase none, and attack the oven with steel wool and elbow grease (probably the best option from an environmental standpoint, unless the life cycle environmental impact of steel wool is greater than the life cycle environmental impact of any of the cleaning products available).

On the other hand, the West German program does label products such as low-pollutant coatings and corrosion protection coatings low in lead and chromates.

Probably the most practical basis for deciding whether or not to label a product with hazardous or harmful content is to examine the possible substitute products or processes. It may not be possible, for example, to find a suitable corrosion protection coating for a given application which does not contain any lead or chromates, so it would be important to know which products contain the least of these harmful materials. On the other hand, perhaps all oven cleaners contain environmentally harmful materials, but the desired result can be obtained without using chemical cleaners, and therefore labeling of chemical cleaners is not necessary.

COMPLETE LIFE CYCLE ANALYSIS VERSUS EASIER, QUICKER METHODOLOGIES

The main two issues here are time and expense involved in analysis versus environmental benefit, and consumer loyalty and possible disillusionment or confusion.

As discussed in Chapter 4, a true cradle-to-grave life cycle analysis is time-consuming, expensive, and raises difficult questions about weighting the relative importance of various environmental impacts. Quick and easy judgments made on the basis of one or limited criteria tend to give clearcut "black and white" answers, which may, however, be misleading in terms of overall environmental impact. Unfortunately, the less technical research that goes into an evaluation, the sooner the potentially erroneous conclusion can be released to the public—a public increasingly eager to do the right thing environmentally.

Once environmentally-committed consumers have embraced an idea, it may be difficult to change their minds with the facts. A case in point is shopping bags. "Everybody knows" that paper shopping bags are better than plastic because paper bags are degradable and recyclable (judgment based on limited criteria). Supermarkets began courting environmentally conscious consumers by promoting the use of paper bags, with enthusiastic public response. Environmental groups published shopping guides urging consumers to refuse plastic and demand paper. Sometime later, several life cycle studies were released showing that polyethylene bags use less energy and resources than paper bags (67). Where are the "demand plastic" campaigns? Instead, some stores are providing bins to collect used plastic bags for recycling, and environmental guides are advocating reusable cloth bags over paper and plastic (8, 10).

The time, expense, and resolution of gray areas involved in life cycle analysis compared to limited criteria evaluations is also a controversial point for clean product programs. Some argue that consumers want information now, and that delays for comprehensive evaluations will result in impatient consumers using unsubstantiated, unregulated manufacturers' claims as a basis for their purchasing decisions. This may result in no net environmental benefit or even conceivably harm, and may leave consumers so confused or cynical that they lose faith in the effort. The Attorneys General of several states are currently investigating the substantiation for environmental claims associated with several types of products including trash bags and diapers (19, 35). The opposing argument is that it is most important to ensure that information supplied to the consumer be correct, reliable, and as complete as possible; otherwise the program becomes nothing more than a marketing gimmick (25, 32).

HANDLING TRADE-OFFS

In complete life cycle analyses, summaries of environmental impacts such as total energy usage or water usage associated with one product can be directly compared to the same impacts associated with another. Problems arise over weighting different impacts relative to each other, such as different categories (less energy usage but more solid waste produced), different streams (less air pollution but more water pollution), and different components in the same stream (less heavy metals but more toxic organics in the wastewater stream). There are no established scientific methodologies for deciding which is more important. Following are discussions of some ways to handle these trade-offs, and some pros and cons of each.

Weighting Systems

Two ways to handle environmental impact trade-offs are by designing a weighting system, which is likely to involve at least some subjective judgment as to which components are least desirable or most harmful, or, in particularly difficult areas, by abandoning quantitative comparison of each individual component in favor of combining several under minimum or maximum allowable limits. For example, the allowable limit for production may specify "less than x pounds of toxic materials in effluent water," which would lump together heavy metals, toxic organics, and all other toxic materials without making a direct comparison or requiring a decision on which is more harmful. This in itself represents an unspoken subjective decision that all toxic materials in the effluent water are equally damaging. While this is certainly not entirely accurate, it does provide a simplified and practicable approach.

Standard methodologies for assessing risks from toxic substances do exist and could potentially provide guidance in weighting environmental impacts. These studies generally must be very carefully applied, however; they may contain subjective elements, and may be based on limits that may or may not be directly tied to real risks.

Pass/Fail Systems

Carrying the previous method a little further and replacing most quantitative comparisons with minimum or maximum allowable levels would result in a pass/fail system. This would require less collection and evaluation of quantitative data, but would effectively mask environmental differences among products as long as they did not exceed the limit allowable. Advantages in simplification and consistency of evaluation using this method could be outweighed by misleading conclusions on overall environmental impact.

For example, suppose manufacturers A and B are both interested in obtaining an environmental label for their recycled product. Recycled content requirement is 70 percent. Manufacturer A is running at or just below all pass/fail emission limits, but his product has 70 percent recycled content, and so he is awarded a label. Manufacturer B runs all his processes with pollution well below all pass/fail limits, but his recycled content is only 50 percent. When he raises recycled content to 70 percent, one waste stream slightly exceeds the limit, but all others remain well below. B is denied the label. Whose process is more environmentally sound? (Note: Pass/fail limits should be set tighter than government regulatory standards, otherwise meeting the labeling requirements means nothing more than operating legally. Environmental labels are intended to identify and encourage the development of products that significantly reduce negative environmental impact. Awarding a label for merely meeting regulatory requirements does not encourage innovation in environmental excellence, unless significant improvements are made in other areas while emissions remain constant.)

Letting the Consumer Decide

Another way of dealing with trade-offs is to abandon the idea of a simple environmental logo in favor of presenting more environmental impact information on a label and letting the consumer decide what is environmentally preferable (25). This would be similar to nutrition labeling. Products do not claim to be "nutritionally superior" or "best for health"; rather, information on calories, fat, cholesterol, vitamins, minerals, etc. is provided for the consumer to judge. Food products provide an interesting parallel to "environmentally friendly" products in terms of single criterion advertising, such as "No Cholesterol" (with no mention of fat calories)—comparable to "No CFCs" (with no mention of other toxic chemicals).

Research on nutrition labeling has shown, however, that many consumers are confused by so much information, or do not know how to use it to make effective decisions (11). There is no reason to suspect that the same would not be true of a detailed environmental labeling program. Additional consumer research could be conducted to determine what types of information consumers would consider most useful in making environmentally beneficial purchasing decisions—would they prefer a simple "seal of approval" or more detailed, factual information? A survey conducted by the Michael Peters Group indicated that the majority of consumers would pay extra for products in degradable or recyclable packaging, but the survey did not appear to address issues such as where consumers get their information on products' environmental aspects, and how they use this information to make purchasing decisions (43).

Using Only One Easily Determined Criterion

The advantage of a single criterion approach is that it is easily evaluated and easily understood by consumers. As discussed in several preceding sections, the primary danger of single criterion evaluation is the possibility that judgments will be oversimplified and erroneous conclusions on environmental impact will be reached; therefore, consumer actions based on this will not have the desired environmental effect.

LEGAL IMPLICATIONS OF MAKING SUBJECTIVE JUDGMENTS

No matter which of the previously discussed methods is used to evaluate the environmental friendliness of products, there will be those who do not agree with criteria, evaluation methods, or both. Since it is impossible to be completely objective in evaluating and comparing products because of lack of complete knowledge about all environmental impacts, a highly advisable course of action for groups involved in clean product efforts would appear to be to publish as complete as possible a statement of their evaluation policy. This would include specifying the evaluation method(s) used and the requirements for each: for example, single criterion (define criterion and specify requirements), pass/fail (specify limits and components which they cover), and weighting systems (specify weighting factors for each stream). While this will not prevent disagreement, it will be useful in the event of potential lawsuits. If evaluation policy is not specified in detail, the evaluating organization will be leaving itself open for legal action by disgruntled manufacturers who feel they have been unfairly treated.

IMPLEMENTATION ISSUES

Many criteria can be used for evaluating whether products are "clean" or "environmentally friendly," and some methodologies exist for implementing the evaluations. One of the problems to be resolved is the issue of who or what agency should implement the programs. There are several options.

Agencies That Might Implement Programs

Some of the Clean Product programs that have been implemented in other countries are being done at the national level (e.g., Germany and Canada). In the United States, programs of this kind have not been implemented at the federal level, but there is precedent in some of the activities of the Food and Drug Administration and regulation of toxic substances. This negative type of labeling is clearly different from a program in which the government recommends preferred products, thus influencing consumer purchasing decisions.

A number of states are moving in the direction of some kind of "environmentally friendly" product regulations. The states that are members of the Coalition of Northeastern Governors (CONEG) have been particularly active in this regard, but others (Minnesota, for example) are also pursuing programs of this sort. Packaging of consumer products has most often been the focus of efforts at the state level.

Environmentalist or other nonprofit groups also are involved in studying Clean Product/source reduction issues. Examples include the Conservation Foundation and the Pennsylvania Resources Council. These groups often are in a formal or informal dialogue with EPA and organizations like CONEG.

Finally, private companies are very aware of the Clean Products issue, and many of them have been carrying out their own initiatives, sometimes in connection with groups like CONEG.

POLICY IMPLICATIONS

There would be some advantages to implementing a Clean Product program nationwide. Manufacturers generally find it easier to comply with one consistent nationwide program than a fragmented, state-by-state mixture of regulations. However, having a federal program would not necessarily preclude states or other organizations having their own programs as well. There are many examples of states enacting more stringent regulations than those promulgated at the federal level.

There would also be the necessity of determining which agency(ies) would implement the program. Extensive research would be required, but also an implementation mechanism would have to be developed and administered. Implementation could be through regulations or restricted to educational programs, or some combination of measures.

Another issue with administering a program of this sort is the necessity to update the criteria used to measure products. These criteria can change with time as research provides new information on environmental phenomena. Also, new products are continually being developed, and processes used to manufacture products also evolve over time. For example, many commonly used packages today (e.g. microwaveable containers) hardly existed 10 years ago. New recycling programs are announced almost daily by industrial organizations. The evaluation process would have to be quite flexible to keep up with new development, or run the risk of stifling creativity.

RECOMMENDATIONS

In summary, manufacturers and consumers, the two groups upon whom the success of clean or environmentally friendly products depends, generally appear to recognize the potential benefits of such a plan and indicate that they are eager or at least willing to participate. As yet, however, no universally accepted and supported course of action has been identified. Current efforts by various individual groups may be well-intentioned, but do not adequately address the comprehensive environmental impacts associated with a product's entire life cycle, and therefore may offer consumers misguided direction.

Additional research and effort in several areas could aid in the development and support of a clean products program with less room for erroneous conclusions and consumer confusion. These areas include:

- Standardized definition and usage of environmental impact terminology
- Survey of consumers to find out what types of information/education would be most useful to them in making environmentally beneficial purchasing decisions
- Further development of methodologies to thoroughly and effectively evaluate products on a life cycle basis
- Development of a standardized environmental labeling program
- Other reward incentives for manufacturers providing cleaner products or technologies

Instituting and enforcing standard definitions, evaluation methodologies, etc. and communicating information to consumers will be no small task. The ultimate goal, of course, is to reduce the harmful environmental effects of the production and consumption that fuel our economy and current lifestyle.

Additional measures that could minimize environmental impacts of consumer products might include:

- Education on proper use and disposal of products. A manufacturer of concentrated fabric softener which requires 75 percent less packaging than traditional products expresses concern that the environmental benefits associated with reduced packaging may be negated by consumers failing to dilute the product properly and hence using more of the product than required. As far as disposal, it is important that even cleaner products, such as batteries with reduced levels of heavy metals, be disposed of in a responsible manner.
- Elimination of high environmental impact products for which acceptable, less damaging alternatives exist. For example, aerosol deodorants could be replaced by existing solid and liquid deodorants which require less non-recyclable packaging and no chemical propellants.

Decisions on suitability of substitutes for some products will be more subjective than for other products—for example, should battery-operated watches be eliminated in favor of mechanically wound watches? What about exceptions for consumers with physical handicaps or allergies to certain products?

- Elimination of excess packaging. This issue is already being addressed by CONEG and others (7, 8, 40, 68). It also involves subjective decisions on what packaging is necessary and what is excessive, particularly when it comes to convenience packaging and packaging to enhance attractiveness to consumers.

- Efforts to reshape today's convenience-oriented consumer perspective to a more environmentally responsible attitude. Manufacturers, motivated by profit rather than social concerns, are likely to resist any change that will reduce sales and income. Ways must be found to make this change financially attractive. Some companies, such as The Body Shop in the United Kingdom, have managed to adopt an environmentally responsible theme and become very profitable (2, 4, 5).

The benefits to the environment, and consequently to mankind, that may be gained by support of clean products are considerable. The information provided and issues raised in this report can serve as a starting point.

Appendix A

ANNOTATED BIBLIOGRAPHY

ENVIRONMENTAL BOOKS, SHOPPING GUIDES, AND CATALOGS

1. Council on Economic Priorities. *Shopping For a Better World*. 1989. This guide to "socially responsible shopping" rates name brand products according to the performance of their parent company in areas such as environmental performance, animal testing, charitable contributions, and advancement of women and minorities. Data on characteristics of individual products are not presented; rating criteria are not always clearly defined.

2. Elkington, John; Hailes, Julia; and Makower, Joel. *The Green Consumer*. Tilden Press, 1990. Defines ideal "green" products and offers suggestions for environmentally responsible driving, shopping, and traveling. Contains tables and matrix presentation of data and information to use in assessing environmental impact of products.

3. Elkington, John, and Hailes, Julia. *The Green Consumer's Supermarket Shopping Guide*. London: Victor Gollancz Ltd, 1989. While much of this book is devoted to issues unrelated to this clean products report (e.g., animal cruelty, nutrition), it does include some interesting matrix tables in which certain products and their packaging are rated according to several relevant criteria. In most instances the ratings are in a "pass/fail" (yes/no) mode, but some criteria (e.g., energy use) are stated quantitatively.

4. Hollender, Jeffrey A. *How To Make The World A Better Place*. William Morrow and Company, Inc. 1990. Contains suggestions for addressing and alleviating world problems in areas such as environmental protection, world hunger, peace, and human rights. The environmental section contains information on various categories of products, effects on the environment, and suggestions for individual action.

5. MacEachern, Diane. *Save Our Planet - 750 Everyday Ways You Can Help Clean Up The Earth*. Dell Publishing, 1990. This book assesses the general health of the planet, identifying problems such as "garbage overload," global warming, and

acid rain. Lifestyle adjustments and actions are recommended to alleviate various environmental concerns.

6. Manning, Anita. "Ecology Books Are A Plentiful Resource." USA Today. February 28, 1990. Reviews several recently published books with environmental themes, including guides for environmentally safe shopping.

7. Pennsylvania Resources Council, Inc. Become An Environmental Shopper. September 1988. Shopping guide makes recommendations for environmentally responsible shopping based on the "Four R's": Reduce (amount of trash), Reuse (products and containers), Recycle (as much as possible), Reject (excessive packaging, nonrecyclable packaging, and products harmful to the environment). Provides information on tactics to increase manufacturer awareness of consumer concerns about environmental issues, and information on organizing an environmental shopping campaign.

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9. Ryan, Frank, and Ray, Stephen, for the Ministry for Planning and Environment and the Victorian Association for Environmental Education. 101 Ways to Protect Our Environment. Melbourne, Australia, 1989. Contains suggestions on environmental shopping, product substitution, and resource conservation steps. Shopping tips include using energy efficiency ratings on appliances, avoiding excess packaging, and buying the best quality goods for a longer lifetime.

10. The EarthWorks Group. 50 Simple Things You Can Do To Save The Earth. Earthworks Press, Berkeley, CA, 1989. Assesses environmental problems and gives suggestions for remedial/preventive action.

ENVIRONMENTAL LABELING

11. Applied Decision Analysis, Inc. Environmental Labeling in the United States - Background Research, Issues, and Recommendations. Draft report for Office of Pollution Prevention, U.S. Environmental Protection Agency. December 5, 1989. Presents an overview of existing and proposed environmental labeling programs in other countries, including goals and structures, and briefly discusses a few environmental shopping and labeling programs in the U.S., as well as California Proposition 65. Second section discusses general elements of labeling effectiveness and summarizes a literature review on the effectiveness of several types of existing labeling programs, including food and nutrition labels. Concludes with recommendations as to the goals, functions, and structure of a U.S. environmental labeling program.

12. Associated Press. "Ads With Environmental Claims Must Be Accurate, FTC Warns." The Kansas City Star. March 17, 1990, p. 3. The Federal Trade Commission announced that they will vigorously pursue deceptive environmental claims in advertising and packaging. Various environmental groups and individuals have criticized environmentally-oriented marketing for making misleading claims.

13. Austrian Ministry of Environment, Youth, and Family. Environmental Labelling; Representative Model as of December 1989. Covers various aspects of proposed labelling system, including sections on legal-administrative framework for awarding environmental label, awarding criteria/fundamental guidelines of assessment, and accompanying measures/protection against abuse.

    The proposed structure and procedures are similar to West Germany's Blue Angel program. Generally, the product and its packaging are to be evaluated together, although in a few cases labelling may be awarded for the packaging only. An interesting concept in this model is the use of different colors in the label to designate different categories of environmental soundness; for example, blue for air and water, red for conservation of energy, etc.

14. Beverage Industry. "Environmental concerns boost use of plastic trays." April 1990, p. 39. Environmental concerns are fueling the move toward reusable tertiary packaging in the beverage industry. The shift has mainly occurred in the bottle market, but plastic trays for cans are now being introduced.

15. Canadian Department of the Environment. Environmental Choice Product Guidelines. Under Canadian Environmental Protection Act, Section 8.(1)(b). Approved Guidelines ECP-01-89 through 04, 07, 08, 10, 11, 13, and 14. Discussion Draft Guidelines ECP-01-89 through 03, 09, and ECP-15-90 through 18. Documents contain requirements that products in various categories must meet in order to qualify for an environmental label.

16. Clarke, Marjorie J. "The Paradox and the Promise of Source Reduction." Solid Waste & Power. February 1990. Discusses various methods for achieving source reduction, including government standards for environmentally sound packaging and products, and public education on how to evaluate the environmental merits of purchases.

17. Drayna, Jonathan. "Fort Introducing Recycled At-Home Goods." Marketplace Magazine. Volume 1, Number 6, March 1990. Based on marketing success in environmentally conscious Europe, Fort Howard Corp. has introduced "Green Forest" tissue and paper towels from recycled paper without inks or scents. Fort Howard also plans to test market a toilet paper from recycled newsprint made without bleaching, which is a major source of the water pollution associated with paper recycling.

18. Emissions Standards Division, Office of Air Quality Planning and Standards. Consumer Product Comparative Risk: Market-based Pollution Prevention. Outlines proposed project with objective to examine full risks of some home-use products from cradle to grave, screen them to obtain a focus group, perform a detailed risk scoring of alternative products, and examine how to perform and distribute comparative risk analysis for consumer products. Evaluation would include human health risks and environmental risks. Aim is to prevent pollution by eliminating market demand for products with the most human and environmental health risks.

19. Environment Reporter. "Group Plans Product Labeling Campaign to Combat Deceptive Environmental Claims." The Bureau of National Affairs, Inc. Washington, D.C. April 20, 1990. The National Toxics Campaign launched a drive April 13 to standardize environmental claims on consumer products and stop manufacturers from making false and deceptive claims. The Green Cross Certification Company will award two seals of approval: for recycling (product must contain highest possible recycled content), and total environmental impact (product must be environmentally benign, manufactured in a responsible manner, and be free of excess packaging). The labeling program is being supported

by four Western grocery companies. Labeled products may appear in stores later this year. The Attorneys General of eight states are investigating companies suspected of making false environmental claims, specifically, claims regarding plastic bags, disposable diapers, polystyrene fast-food containers, and "ozone-friendly" aerosol sprays. New York Attorney General Abrams is pushing for a state law to ban unsubstantiated "environmentally friendly" claims, and hopes for action on this issue from the Federal Trade Commission.

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28. Final Report of the Green Spot Advisory Panel. December 1989. Mark Wahlqvist, chairman. Printed by Jean Gordon, Government Printer: Melbourne, Australia. In March 1989, in response to growing consumer concern about products' environmental impacts, the Victorian Government initiated the Green Spot consumer awareness program to promote environmentally sound products. The first stage of the program involved publication of a series of Green Spot Bulletins, advising consumers how to make environmentally sound purchasing decisions regarding various products. The second stage of the program involved forming an advisory panel in May 1989 to investigate the feasibility of a national environmental labeling program and to make conclusions and recommendations. This final report contains proposals and recommendations for an environmental labeling program's structure, operation, funding, selection of product groups, product criteria and evaluation, and marketing. Annexes to the report include comments of various Australian manufacturers, trade associations, and other groups; discussion of environmental labeling programs in other countries (only Canada covered in any depth); and the Green Spot draft criteria for unbleached paper products, chlorine-free paper products, recycled paper, and products made from recycled plastics.

29. Flam, Faye D. "At the Supermarket: A Confusion of Green." Chemical Week. April 25, 1990, p. 13. Scientific Certification Systems of Sacramento, Cal. has been appointed by four West Coast supermarket chains to evaluate the environmental friendliness of consumer goods and award "Green Cross" seals of approval. Green Crosses will be awarded to products that contain an acceptable proportion of "sustainable material and/or recycling material" and are manufactured using processes that omit no toxic substances.

Companies must pay to have their products considered. Supporters, including the National Toxic Campaign Fund, believe that the program will discourage false and misleading claims and guide consumers toward environmentally safe products, while critics contend that the complexity of environmental concerns makes it difficult to label products as good or bad, and will confuse consumers.

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    Criteria should distinguish between products with different environmental properties but common fields of application, and must be defined in such a way that they are measurable. In establishing criteria, the environmental impact of a product at all stages of its life cycle should be considered; it may then be possible to narrow the criteria to a few crucial areas. Since there are no general rules as to which phase of the life cycle or which aspect of environmental impact is most important, each product group must be analyzed to determine its most important environmental impacts and develop the methodology to assess these impacts. In addition, the amount and costs of product testing must be realistic when compared to the price of the product and the size of its market. Criteria used or proposed by various countries are discussed. Problems of establishing criteria are exemplified by considerations applied to real products such as batteries, detergents, and paints.

The structure proposed for an EC labeling program consists of two central bodies to decide upon criteria and advise in criteria development and labeling system operation, as well as national advisory committees in the member countries to pre-select product groups and criteria and handle label applications.

The labeling program should be self-financing within a few years of startup, with fees for use of the label corresponding to the costs of operating the system, including testing, salaries, etc. It is proposed that the fee consist of a basic annual fee plus an additional fee based on product sales. Additional funding could be obtained by imposing charges on heavily polluting manufacturers: the "polluter pays" principle, or "PPP."

Annexes to the report provide additional useful information on environmental labeling in EC member states, Nordic and other EFTA countries, and other countries such as Canada and Japan.

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must be wary of irresponsible or misleading claims. Exploitative environmental marketing has the danger of resulting in consumer cynicism and resulting loss of effectiveness of environmental advertising. Companies which make environmental claims should be prepared for thorough scrutiny and resulting negative public relations impact if found lacking in environmental commitment and performance, even in other areas of their company. Realistically, a company cannot expect its environmental efforts to please everyone, and must be prepared to deal with criticism.

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0164, Oslo 1 Norway. General information on purpose of environmental label, participating Nordic countries, product eligibility, and effectiveness of environmental labeling, with reference to German Blue Angel program.

42. Norwegian Foundation for Environmental Product Labels. The Norwegian Foundation for Environmental Product Labels - Status per April 1990. Kristian Augusts gate 5, N-0164, Oslo 1 Norway. Voluntary Nordic environmental labeling scheme will be introduced in 1990. Labels will be awarded to products least harmful to the environment, with a fee charged for use of the label. The structure and function of the Norwegian labeling foundation is explained. The first products carrying the label should be on the market in late 1990.

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44. Packaging. "City of Berkeley Calls for Precycling." October 1989. The city of Berkeley, CA, is trying to encourage consumers to make environmentally wise purchasing decisions. Along with technically valid suggestions, endorses biodegradability and criticizes plastics for not being degradable.

45. Packaging. "Special Report: Packaging Under Attack." August 1989. Various articles address the environmental impacts of packaging, including misconceptions about various materials, legislation aimed at banning or restricting packaging, consumer attitudes, environmentally sound disposal methods, and package design to address environmental concerns.

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sound. Popular products marketed as "environmentally friendly" include degradable plastic bags and diapers, refillable concentrated pouches, and dioxin-free paper products. Manufacturers and supermarkets alike are getting involved.

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52. Smith, Randolph B. "Rush to Endorse 'Environmental' Goods Sparks Worry About Shopper Confusion." Wall Street Journal. April 16, 1990. Environmentalists, government officials, and manufacturers are voicing concern about environmental labeling. Specific areas of concern include consumer confusion, claims of unfair or misleading labels, inconsistency in seals or labels awarded by different groups, and how to set definitions and requirements for terms such as "recycled." Article reviews current status of various environmental, manufacturer, and retailer programs and proposed legislation, including Green Seal, Inc., Green

Cross labeling (recently supported by four Western supermarket chains), and CONEG action.

53. Solid Waste Report. "Green Marketing Challenged by Attorneys General." March 19, 1990, p. 94. Eight states' attorneys general are conducting hearings in St. Paul concerning standards for environmental marketing, based on concern about advertisers' growing claims about "environmental friendliness" of their products. Hearings will focus on how to label products claiming environmentally protective qualities.

54. Swedish Ministry of Public Administration. Environmental Labelling in Sweden. November 29, 1989. Discusses plans for a coordinated Nordic environmental labeling system.

55. U.S. Environmental Protection Agency. Promoting Source Reduction and Recyclability in the Marketplace. September 1989. Sections of the report relevant to clean products include information on consumer education and influencing the relationship between consumers and marketers. Education should be aimed at increasing awareness of municipal solid waste crisis and environmental consequences of purchasing decisions. Reviews some environmental shopping campaigns and Canadian Environmental Choice program. Problems include lack of standard definitions and labeling for recycled content or recyclability. Does not contain much technical information on clean products, rather focuses on opportunities for promoting environmentally acceptable products through consumer education and motivation, and resulting purchasing decisions. Lists suggested activities for consumers, industry, and government.

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57. Wall Street Journal. "Aerosol Alternatives Rush Into the Market." May 7, 1990. Although CFCs have been banned as an aerosol propellant, current hydrocarbon propellants still contribute to smog, leading manufacturers to search for new ways to dispense aerosols. Methods under development

include use of mechanical methods or liquefied hydrofluorocarbons, which don't hurt the ozone layer or cause smog.

58. Watkins, Angela. "Gaining an Environmental Edge." Beverage Industry. February 1990. Spokesmen for Pepsi-Cola and Coca-Cola say they do not plan to extend their "green" marketing past current reminders to customers to recycle their beverage containers. Both companies also encourage in-house recycling, reduced packaging, and recycled packaging materials.

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ENVIRONMENTAL IMPACT INFORMATION

62. Backman, Mikael, et al. Preventative Environmental Protection Strategy: First Results of an Experiment in Landskrona, Sweden. TEM/University of Lund. Outlines case studies of several manufacturing companies assisted by TEM in redesigning their manufacturing processes to reduce negative environmental impacts.

63. Bal, Raj. "Degradable Bags Help The Environment." USA Today. March 16, 1990. Author's firm, Webster Industries, manufactures degradable bags with 50 to 100 percent recycled plastic. A harmless additive allows bags to degrade in landfills even with no moisture or light. After degradation, only carbon dioxide, water, and harmless soil-

like residue remain. Degradable bags are not the single solution but combined with source reduction and recycling can make a pro-environment contribution.

64. Boustead, I. The Environmental Impact of Liquid Food Containers in the U.K. The Open University, East Grinstead, U.K. October 1989. Assesses environmental impacts of 10 types of containers for 14 types of liquid foods. Provides general discussion of raw materials (renewable, non-renewable, mineral), waste (materials, heat), and post-consumer waste. Lists factors and assumptions used in calculations. Tabulated results include total system energy by container and by liquid, raw material requirements for 26 raw materials by container and by liquid, mass and volume contribution to refuse by liquid, relationship between package size, energy/container and energy/liter, and energy savings per kg of container material recovered.

65. Council on Plastics and Packaging in the Environment (COPPE). Questions & Answers on Plastics Packaging and the Environment. July 1988. (COPPE, 1275 K Street NW, Suite 300, Washington, DC 20005) General information on plastics in the waste stream, opportunities for recycling and waste-to-energy incineration; also, benefits and drawbacks of degradability.

66. Denison, Dr. Richard A. "Right Question, Wrong Answer." U.S. EPA Pollution Prevention News. February 1990. Biodegradable plastics are not environmentally preferable because sanitary landfills do not promote biodegradation, degradable plastics provide a threat to plastics recycling, may release toxic substances into the environment when they degrade, and may encourage littering.

67. Federal Office of the Environment, West Germany. Comparison of the Effects on the Environment from Polyethylene and Paper Carrier Bags. 1986. Study investigated the input of raw materials and energy, damage to environment during manufacture and waste management, possibilities of recycling and influences on environment from recycling. Assumptions and sources of data listed. Concludes that use of plastics is ecologically justifiable, and with respect to environmental parameters is more advantageous than alternative products. Any significant relief to the environment, however, is only achieved by repeatedly use of a reusable carrier bag, regardless of its material.

68. Final Report of the [CONEG] Source Reduction Task Force. Coalition of Northeastern Governors. September 8, 1989. Contains preferred packaging guidelines aimed at reducing

disposal impacts of packaging waste by changing to more environmentally benign materials, reducing volume and weight of disposal packaging, increasing recyclability and recycled content of packaging, all without impairing the necessary functions of packaging. Packaging guidelines in order of preference are 1) no packaging 2) minimal packaging 3) consumable, returnable, or refillable/reusable packaging, and 4) recyclable packaging/recycled material in packaging. In addition, the Source Reduction Task Force recommends that the CONEG governors direct the Northeastern Source Reduction Council to draft state legislation to reduce to the maximum extent possible toxics such as lead, cadmium, and mercury in packaging.

69. Flexible Packaging Association. Flexible Packaging...Less Does More. Discusses benefits of flexible packaging including energy consumption, volume, weight, and cost in comparison to similar packaging using alternative materials.

70. Goldstein, Nora. "The Packaging Challenge." In Business. January/February 1990. Suggestions for environmentally sound packaging. Discusses current legislative efforts and criteria aimed primarily at plastics packaging. Recommends using fewer layers of packaging, selling refills, and encouraging customers to bring their own containers for filling.

71. Hamilton, Martha M. "Advertisers' Environment Claims Hit." The Washington Post. March 15, 1990. Biodegradability of plastics is under attack by environmentalists and government regulators. A Greenpeace study indicates that biodegradable plastics merely break down into smaller pieces, with no evidence so far that it degrades as do plant and animal products. The vice president of Archer Daniels Midland Company, a manufacturer of cornstarch additives for degradable plastics, says that the company's product tests have not been underway long enough to demonstrate the final results of the decomposition process, but that their studies show the products break down in a way that will result in a complete biodegradable decomposition. A senior scientist for the Audubon Society considers current biodegradable plastics a hoax, but thinks the concept is valid. Audubon Magazine switched from paper wrappers to polyethylene because it is less polluting on a life cycle basis than paper.

72. Industry Committee for Packaging and the Environment. Packaging Saves Waste. London, 1987. Analysis of composition and quantity of household wastes, benefits of packaging and recycling. Predicts future trends toward more

lightweight and combination material packaging as well as more recycling of single polymer plastics and waste-to-energy conversion of combination packaging.

73. Levy, Michael H. U.S. EPA Briefing - Source Reduction/Plastics Packaging. January 15, 1988. Prepared for Office of Solid Waste and Emergency Response. Lists plastics packaging contributions to source reduction, advantages of plastics packaging. Discusses more plastics being recycled and converted to energy, and the unknown effect of elimination of convenience packaging.

74. McDonald's Environmental Affairs. McDonald's and the Environment. Pamphlet published by McDonald's Corporation, McDonald's Plaza, Oak Brook, IL 60521. 1990. Outlines environmental considerations taken into account by McDonald's regarding polystyrene foam packaging (effect on ozone, percent of solid waste stream, efforts to recycle), other reductions in packaging, company policy refusing to purchase beef from deforested rain forest land, and contributions to public environmental education.

75. Packaging Age. "Solid Waste - The Packaging Challenge of the Eighties." August-September 1988, pp. 6-11. Gives overview of packaging contribution to solid waste problem and discusses government and industry attitudes and programs under consideration to address the problem. Preferred course of action: Recycling, Reuse, Reduction.

76. Polystyrene Packaging Council, Inc. (1025 Connecticut Ave. NW, Suite 513, Washington, DC, 20036) Polystyrene Foam Food Service Products: Environmental Impact and Waste Disposal Implications. Lists benefits of foam products: cost, sanitation, performance qualities, and energy savings. Concerns about usefulness of degradable products. Discusses alternatives to landfill disposal: recycling into non-food service products, waste-to-energy incineration. Banning is not solution to solid waste dilemma.

77. Procter & Gamble. (1 Procter & Gamble Plaza, Cincinnati, Ohio, 45202) Solid Waste Solutions: Procter & Gamble's Commitment. Discusses each of the following approaches to solid waste problem: Source reduction, recycling, reusing, composting, incineration, landfill.

78. Rapaport, David. "Degradable Plastic Bags Are A Scam." USA Today. March 16, 1990. "Degradable" plastics are not actually biodegradable, according to a study conducted for Greenpeace by the Center for Biology of Natural Systems at Queens College. Under ideal conditions they break into

small plastic fragments that may release new toxic pollutants into the environment. It is better for consumers to avoid unnecessary disposable products in favor of products such as reusable cloth bags and diapers.

79. Statler, Jean C. "Is Degradability a Solid Waste Solution?" U.S. EPA Pollution Prevention News. February 1990. Biodegradability of plastics is not a solid waste solution. Increased recycling of plastics, along with source reduction and waste-to-energy incineration are more valuable, workable solutions.

80. Time Magazine. Special Advertising Section sponsored by the Council for Solid Waste Solutions. "The Urgent Need to Recycle." July 17, 1989. Recycling requires collection, sorting, reclamation, end-use. More and more uses being developed for recycled plastics. Brief discussion on degradable plastics.

81. U.S. Congress, Office of Technology Assessment. Facing America's Trash: What Next for Municipal Solid Waste. U.S. Government Printing Office. October 1989. While this report contains little reference to "clean" products and labeling, it provides a wealth of information on waste composition and various waste prevention and disposal scenarios often used to assess products' or materials' "environmental friendliness."

82. U.S. Environmental Protection Agency: Hazardous Waste Engineering Research Laboratory. Waste Minimization Opportunity Assessment Manual. July 1988. Does not directly address clean products, but contains information on tracking wastes, prioritizing waste streams, etc. and worksheets including evaluation by weighted sum matrix that could be adapted for use in evaluation of clean products.

83. Warmer Bulletin. "Degradability: A False Prophet." Spring 1990. Discusses disadvantages of degradable plastic, including potential to contaminate plastic recycling, epitomizing and perhaps encouraging throw-away mentality (since they are not recoverable or reusable), wasting nonrenewable petroleum resources, possibility of releasing heavy metal contents or environmentally harmful organic compounds as they break down, and hygiene risks associated with packaging which degrades. Proclaims recycling and energy recovery are better solutions than degradability.

STATE, GOVERNMENT LEGISLATIVE ACTIVITY

84. ASTM Standardization News. "Packaging Recycling and Disposability Subcommittee Forms." February 1990. Subcommittee D10.19 on Packaging Recycling and Disposability will develop standards to assist governments in managing solid waste issues. The subcommittee will standardize terms such as recycled material, degradability, etc. and form task groups on methodology for determining degradability and methodology for determining toxic content in packaging material. The group will work with CONEG Source Reduction Council to draft legislation for reduction of toxic content in packaging.

85. Batdorf, Tracey L. "Maine ban could force changes in aseptics." Beverage Industry. April 1990, p. 40. Maine's ban of aseptic packaging, effective September 1, 1990, is stimulating manufacturers to make aseptics more environmentally friendly. International Paper is looking at replacing the aluminum in its containers so they are more recyclable, or composting them. Tetra Pak claims to be very close to being able to recycle aseptics and is involved with a pilot plant that manufactures particle board from 100 percent aseptics.

86. California Legislature. Assembly Bill Number 3994. Introduced by Assembly Member Sher. March 2, 1990. Bill would declare legislative intent to establish California Environmental Choice Labeling Program to identify products, processes, services, and packaging provided by businesses which comply with specific environmental protection principles.

87. California Legislature. Assembly Bill Number 3030. Introduced by Assembly Member Hansen. February 20, 1990. Bill would require California Integrated Waste Management Board to license use of environmentally safe product labels. Board would establish labeling program and Source Reduction Advisory Committee would advise board on the design, application for licensing (fee involved), and standards for product to meet in the program.

88. Franklin Associates, Ltd. Recent Restrictive Legislation on Plastics Packaging and the Solid Waste Consequences. Draft report, September 1989. Summarizes recent state and congressional legislative activity. Motivation for legislation and perceived advantages for general categories and specific products are discussed. Also examines environmental consequences of restrictive legislation.

Various packages affected by restrictive legislation are examined, along with possible substitute packages, for their environmental impact in scenarios such as incineration, recycling, and degradability. This report is notable as it presents rarely encountered direct comparisons of the environmental impacts of substitutes, which are rarely specified in any detail in restrictive legislation.

89. General Assembly of Pennsylvania. Senate Bill Number 1219. Introduced by Fisher et al. September 25, 1989. Act would provide for labeling of recyclable products and plastic containers, mandate the use of environmentally acceptable packaging in retail food establishments, and encourage cooperation among the states to set uniform policies to reduce unnecessary packaging.

90. Minneapolis City Council. An Ordinance of the City of Minneapolis [a new chapter 204]. March 27, 1989. Ordinance seeks to minimize nondegradable, nonreturnable, and nonrecyclable food and beverage packaging at retail food establishments.

91. Oregon State Senate. SB 990A - The Solid Waste Reduction Act of 1989. April 30, 1989. Prohibits use of polystyrene foam packaging unless on-premises collection program for recycling exists, requires labeling of plastics to facilitate recycling, prohibits stores from using plastic bags unless paper bags also offered.

92. Parker, Bruce J. "Suffolk Ban Null and Void, But the Debate Goes On." Recycling Times. April 10, 1990, p. 2. Supreme Court of New York has overturned Suffolk county's ban on non-biodegradable plastic packaging. The local legislature, which had intended the ban to encourage the use of recyclable paper products and thus slow the filling of landfill space, did not prepare an environmental impact statement to prove that the effect of the ban on the environment would actually be beneficial. Meanwhile, in Oregon, Portland's ban of polystyrene foam in food service industries has been upheld by a state circuit court.

93. Sternberg, Ken. "Canada Gets Friendly, Environmentally." Chemicalweek. April 11, 1990, p. 12. Environmental minister Lucien Bouchard, aiming to make Canada "the industrial world's most environmentally friendly country" by the year 2000, has put together a "Green Plan" of proposed policies, including taxes on waste effluents and hazardous chemicals, emissions trading program, and requiring industry adoption of specific goals and operating procedures.

94. Suffolk County, New York. Intro. Resolution No. 1869-87 - A Local Law to Simplify Solid Waste Management by Requiring Certain Uniform Packaging Practices within the County of Suffolk. Introduced by Legislators Englebright et al. August 25, 1987. Seeks to eliminate use of nonbiodegradable packaging at retail establishments.

Appendix B

PERSONAL CONTACTS

Assarsson, Bo. Head of SIS (Swedish Standards Institution) Environmental Labelling Program. Personal correspondence.

Burger, Alyssa. E Magazine. Personal communication.

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Egli, Norbert. Swiss Association for Waste Reduction. Personal correspondence.

Jensen, Birger. Swedish Ministry of Public Administration. Personal correspondence.

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Stavely, Janice. Program Director, Pennsylvania Resources Council, Inc. Personal communication and correspondence.

Stokke, Jan Erik. Norwegian Foundation for Environmental Product Labels. Personal correspondence.